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CCTC QUICK-REACTING GENERAL WAR GAMING SYSTEM (QUICK)

VOLUME III

WEAPON ALLOCATION SUBSYSTEM

USERS MANUAL

DEFENSE COMMUNICATIONS AGENCY

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THE CCTC QUICK-REACTING GENERAL WAR GAMING SYSTEM

(QUICK)

Users Manual.

Volume III • Weapon Allocation Subsystem.

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JUN 29 1978
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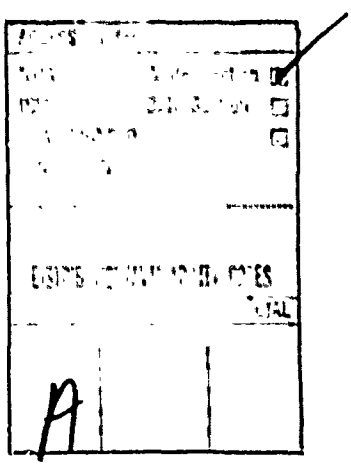

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ABSTRACT

The computerized Quick-Reacting General War Gaming System (QUICK) will accept input data, automatically generate global strategic nuclear war plans, provide output summaries, and produce input tapes to simulator subsystems external to QUICK. QUICK has been programmed in FORTRAN for use on the CCTC HIS 6000 computer system.

The QUICK Users Manual consists of four volumes: Volume I, Data Management Subsystem; Volume II, Weapon/Target Identification Subsystem; Volume III, Weapon Allocation Subsystem; Volume IV, Sortie Generation Subsystem. The Users Manual complements the other QUICK Computer System Manuals to facilitate application of the war gaming system. This volume, Volume III, provides detailed instructions for execution of the Weapon Allocation Subsystem and the modules it comprises. Companion documents are:

a. PROGRAM MAINTENANCE MANUAL
   Computer System Manual CSM MM 9-77, Volume I
   Computer System Manual CSM MM 9-77, Volume II
   Computer System Manual CSM MM 9-77, Volume III
   Computer System Manual CSM MM 9-77, Volume IV
   Provides detailed instructions for maintenance of the system

b. TECHNICAL MEMORANDUM
   Technical Memorandum TM 153-77
   Provides a nontechnical description of the system for senior management personnel

SECTION 1. GENERAL

1.1 Purpose

This volume of the QUICK Users Manual informs the CCTC user/analyst in the preparation of control cards, structure of execution (run) decks, preparation of computer job requests, and in the analyzation of the associated computer output, to include the recognition of error messages for the Weapon Allocation subsystem of QUICK. It complements information contained in the Program Maintenance Manuals of the QUICK System. The abstract of this document references other documents describing QUICK.

1.2 General Description

The Weapon Allocation subsystem uses the integrated data base as defined by all preceding modules and produces a plan using the weapon resources specified to maximize the expected target value destroyed. The subsystem consists of modules PREPALOC, ALOC, EVALALOC, and ALOCOUT, as shown in figure 1. Figure 2 shows the relationship of the Weapon Allocation subsystem to other QUICK subsystems in terms of procedural and information flow.

The modules and supporting subroutines of this subsystem are used to define information for use in later processes and allocate given weapons to targets to optimize expected value destroyed. Modules for this subsystem must be executed sequentially in the order presented within figure 1 (EVALALOC is an optional execution).

The first module, PREPALOC, precomputes much of the information required by later processors. It organizes the input data for efficient use by other components of the Weapon Allocation Subsystem. In addition, it provides capabilities for planning factor modification and fixed weapon assignment specification.

The basic data manipulated by this module include the distance and attrition factors for the weapons, the geographic description of the bomber penetration and depenetration corridors, the weapon characteristic tables (e.g., warhead and payload tables), and the target characteristics.

The next module, ALOC, performs the allocation of weapons to targets. Using a generalized Lagrange multiplier method, an optimal allocation is generated subject to several forms of user-input allocation constraints. These constraints include specification of minimum and maximum desired damage levels, restriction of weapons to specified subsets of the target system, and specification of weapons allocated to specific targets by the user. Within these constraints, the module generates the allocation which maximizes the expected value destroyed in the target system. Module ALOC is also referred to as the Allocator.

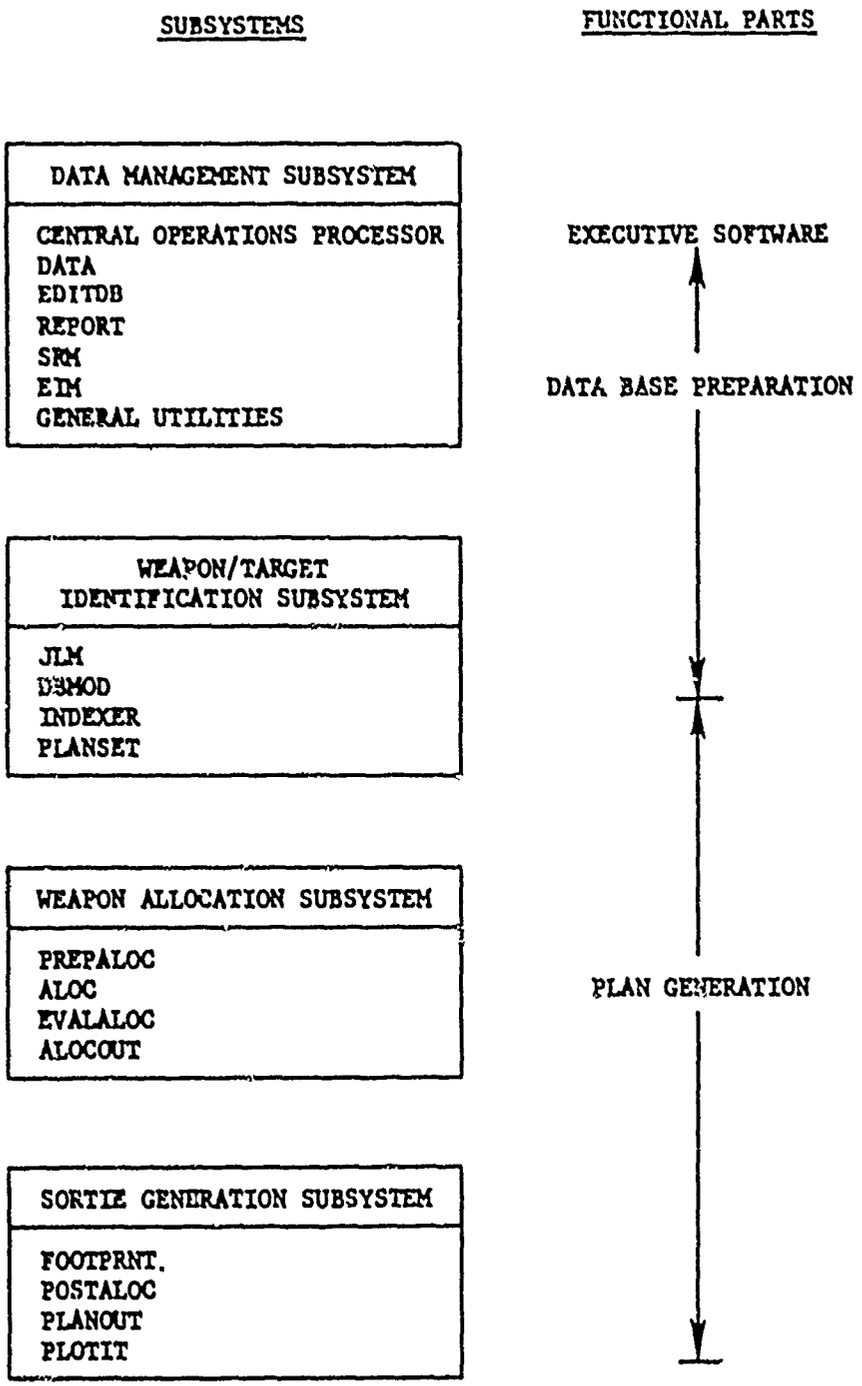


Figure 1. Major Subsystems of the QUICK System

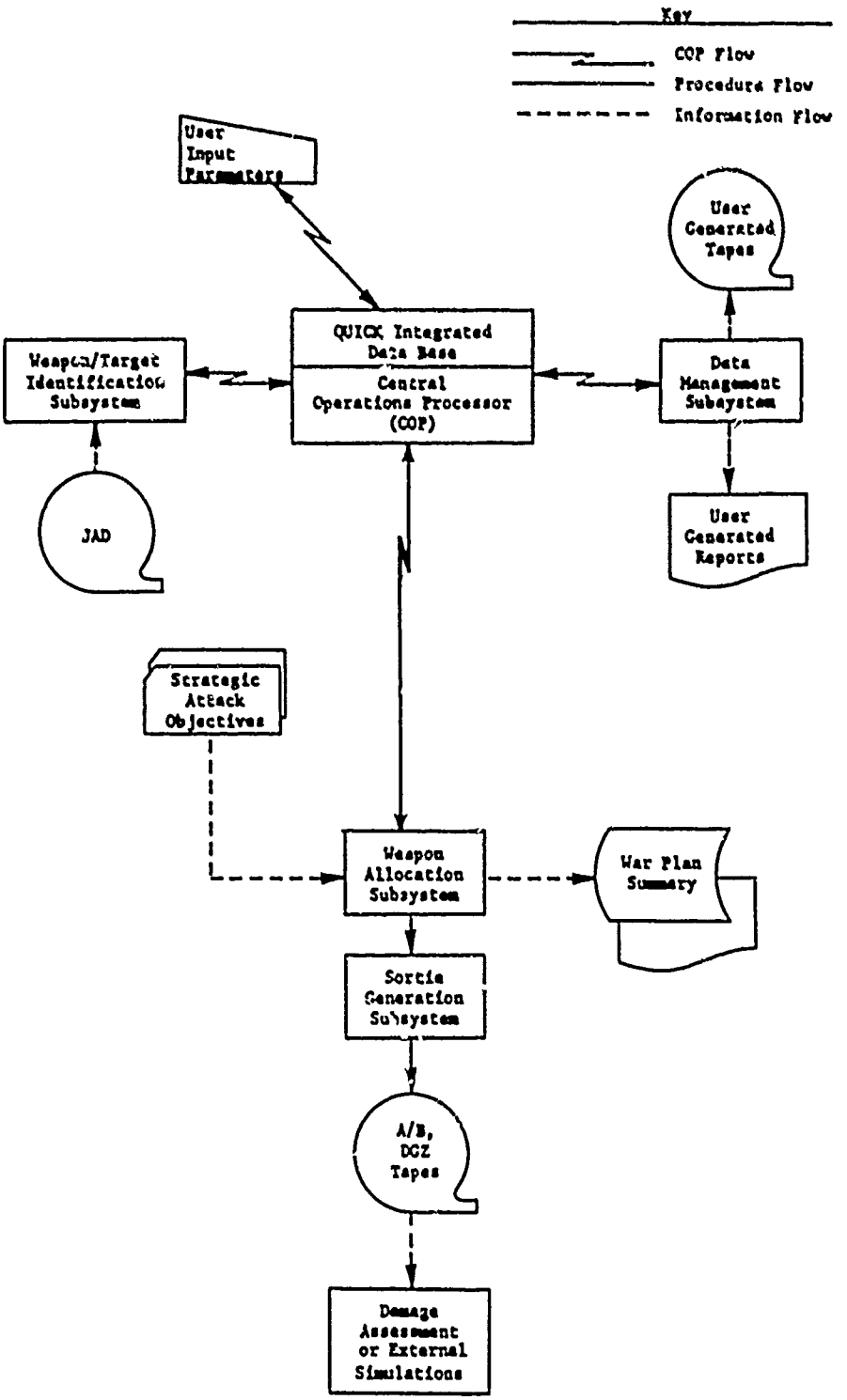


Figure 2. Procedure and Information Flow in QUICK/HIS 6000

Module EVALALOC provides a summary of the allocation produced in program ALOC by calculating an expected-value estimate of its results. In addition, the module has the capability of evaluating the effect upon the results of variations in input values for weapon and target parameters. Module EVALALOC may be run either before module ALOCOUT or after module PLANOUT.

ALOCOUT optimizes the location of aim points for target complexes and collects all the strikes assigned to each weapon group by the Allocator so that detailed plans for each group can be formulated by FOOTPRNT and POSTALOC.

ALOCOUT reads the allocation to each target within the data base. Also, it reads in all the individual elements of a target complex (or complex target) and uses the information to select efficient desired ground zeros for each weapon allocated to the target complex. The resulting strikes with actual aim points (and offset aim points where appropriate) are then sorted for use within the Sortie Generation subsystem.

1.3 Organization of Users Manual, Volume III

In general each major section of this manual is subdivided into two major subsections. These are:

a. Module input - details the set-up of input data files and how they are used in a given module.

b. Module output - details the scope and content of module output, with notated examples.

This manual is concerned with data input and output. The standardized QUICK Job Control Language (JCL) is outlined within User Manual Volume I.

SECTION 2. MODULE PREPALOC

2.1 General Purpose

Module PREPALOC (executed after PLANSET) has four major capabilities: updating of weapon group and target attributes, modification of target values, damage constraints and height-of-burst specification, preparation of data for the fixed weapon assignment capability of module ALOC, and the geographical related parameters.

Weapon groups formulation resides within module PLANSET. PREPALOC permits the user to add weapon strikes (called overallocation) to weapon groups whereby providing the allocation greater flexibility in making assignments which ignore serial constraints. The allocator attempts to assign the true inventory plus the added weapons. The Sortie Generation subsystem selects only the inventory number of strikes.

The second major capability of this module is the modification of the target characteristics, VTO, MINKILL, and MAXKILL. VTO is the value of the target relative to the others. MINKILL is the minimum fraction of value that must be destroyed, and MAXKILL is the maximum desired fraction destroyed. Any of these parameters may be changed for any target. The change requests can change these parameters for a single target or for a set of targets. The set of targets for which a change is requested is identified by target class, type, and individual identifier (target designator code (DESIG)), or any combination of these. For complex targets, the class, type, and designator code of each component will be checked to determine if a target parameter for the complex is to be changed.

An additional planning factor which can be modified in this program is weapon height of burst. In the absence of any user specifications, QUICK uses the height of burst for each weapon/target combination that produces the most damage. However, the user can specify use of air or ground bursts in preference to the optimal height. The user can request ground or air bursts on the basis of weapon type, target designator code, target type, target class, target country location, or target region.

The third major capability is the request for allocation of specific weapons to specific targets. (These requests are called "fixed assignments.") This fixing of weapons to targets enables the user to determine part of the weapon allocation while leaving the allocation module free to determine the remaining allocation. In addition, the time of arrival at target or salvo launch number can be fixed for missile weapons. This information will be passed to module PLANOUT which will adjust the launch time accordingly. The specified fixed assignment of weapons remains in effect for the remainder of the plan generation process. Later modules will retain the assignments as best possible.

(For example, it is possible to fix a set of weapons from a weapon group with multiple independently targetable reentry vehicles (MIRV) in such a manner that there are no feasible footprints that cover that target set adequately. In that case, some of the fixed assignment requests must be ignored.)

The fourth major capability is the calculations and IDS torage of all distances and attrition between corridor doglegs for use by other processors. Also the distance between deponetration corridor and recovery bases is calculated and stored.

2.2 Input

2.2.1 General. Text English commands to this module permit the setting of new target values, MINKILL or MAXKILL as well as specifying weapon height of burst. Also certain gaming parameters are set which define the game to be executed. One final consideration is permitting the user to directly assign weapons to individual targets.

This module recognizes the verb PREPARE and adverbs SETTING, FIX, and ONPRINTS (request for optional prints). The general form of the command is:

PREPARE [SETTING [game-parameter {EQUAL / =} value]
[(attribute-1, attribute-2) {EQUAL / =} (value, value) [AND
(value, value). . .]]]
[FIX (DESIG [, DESIG] , GROUP [, {SALVO / ARRIVE}]) {EQUAL / =}
(desig [, desig] , value [, value])
[AND (desig [, desig] , value [, value]) . . .]]
[ONPRINTS number number, first-last number . . .]

2.2.2 The SETTING Adverb. Two main sets of data are considered under this clause. The first permits the definition of variables that will finalize the game scenario being executed. The second allows the user to set attributes in various combinations of subsets whereby target value, MINKILL, MAXKILL or height-of-burst overrides previous inputs or calculations.

2.2.2.1 Gaming Parameters. The user has the capability to input values for parameters given in table 1. If inputs are absent, default values are used. Simply, values are entered as:

INITSTRK=1

For any given weapon group, weapons will be added for sortie generation constraint considerations. The number of weapons in each group will be

WEAPONS*(1.0 + PEX + (EXN/VEHICLES))

where WEAPONS and VEHICLES are PLANSET determined; PEX=PEXBOMB, PEXMISS, or PEXMIRV; and EXN=EXNBOMB, EXNMISS, or EXNMIRV.

2.2.2.2. Target Modifications. The target modification portion of the setting clause allows the user to change target value, minimum or maximum required destruction fraction, and height of burst on any target or set of targets. In the general command sentence given above, generic word attribute-1 refers to the identification of the target set over which a specific change is to be effective. Generic word attribute-2 refers to the attribute that is to be changed. Therefore:

attribute-1 = DESIG (designator code), TYPE (type name), CLASS (target class name), CNTRYL (target country location), or IREG (target region)

and

attribute-2 = VALUE (target value), MINKILL (minimum value destroyed), MAXKILL (maximum value destroyed), or IDHOB ((target height of burst specification), air or ground)

Any combination of target subsetting is permissable but there is a ranking order in the final storage of input values. The order of priority is: DESIG, TYPE, CLASS, CNTRYL, IREG. That is, if a given target is referenced by more than one output target set, the cited order applies.

Consider:

(TYPE,VALUE) = B52,10) (CNTRYL,VALUE) = (US,20) (CLASS,VALUE) = (MISSIL,10) (DESIG,VALUE) = (AB123,30)

In terms of the hierarchy, all targets located within the US will have a value of 20; all B52s and MISSILs will have a value of 10 (even if located within the US); and the individual target AB123 will have a value equal to 30.

If some targets within the given subset are components of a target complex, the planning factors for the complex would be changed to agree with the modified values for the components. If an attempt is made to modify the same planning factor for a complex target as a whole, and

Table 1. Game Related Parameters

MNEMONIC	DEFAULT	RANGE	DESCRIPTION
INITSTRK	1	1 or 2	Strike type (first or second). In the first strike case, the launch timing is determined by the other two input parameters. In the second strike case, all alert weapons launch after their specified alert delay (ALRTDL), all nonalert weapons launch after their nonalert delay (NLRTDL), and the detailed coordinated missile timing parameters in program PLANOUT are ignored.
CORRMISL	0.0	0.0-1.0	Gross missile launch timing. Defined as the fraction of missile flight completed at time zero. A value of 0.0 specifies missile launch; a value of 1.0 specifies missile impact.
CORRBOMB	0.0	≥0.0	Bomber launch timing. The number of nautical miles prior to the corridor entry that each bomber reaches at time zero.
PEXBOMB*	0.0	≥0.0	The fraction of bomber weapons added for each weapon group for over allocation.
EXNBOMB*	3.0	0.0-1000.0	Vehicle 'loads' added to each bomber group. A vehicle 'load' is the ratio of the number of weapons (PLANSET determined) to the number of vehicles
PEXMISS**	0.0	≥0.0	Same as PEXBOMB for non-MIRV missiles
EXNMISS**	0.0	0.0-1000.0	Same as EXNBOMB for non-MIRV missiles
PEXMIRV**	0.1	≥0.0	Same as PEXBOMB for MIRV missiles
EXNMIRV**	2.0	0.0-1000.0	Same as EXNBOMB for MIRV missiles

* These parameters are modified for bomber groups with less than 15 bombers.

** These variables must be such that the total number of vehibles per group (including overallocation) does not exceed 1030 for bombers and 1130 for missiles.

also on a component of that complex, the former change will be effected and the latter change will be ignored.

In the absence of a height-of-burst specification, the optimal height is used. When changing VALUE, the normalized VALUE should be entered.

In summary, then, this phrase of the SETTING clause is:

$$\underline{\text{PREPARE SETTING}}\ \left(\left\{ \begin{array}{l} \underline{\text{DESIG}} \\ \underline{\text{TYPE}} \\ \underline{\text{CLASS}} \\ \underline{\text{CNTRYL}} \\ \underline{\text{IREG}} \end{array} \right\} , \left\{ \begin{array}{l} \underline{\text{VALUE}} \\ \underline{\text{MINKILL}} \\ \underline{\text{MAXKILL}} \\ \underline{\text{IDHOB}} \end{array} \right\} \right) = \underline{\text{(value, value)}} \ \ldots$$

All combinations are permitted except that CNTRYL and IREG may only be used in connection with IDHOB.

2.2.3 The FIX Adverb. The optional fixed assignment clause specifies the allocation of weapons to specific targets. A fixed assignment of weapons from a specific group to a specific target is maintained by module ALOC, which optimizes the assignment of the nonfixed weapons. In addition, the delivery time (minutes relative to H-hour) of non-MIRV missile weapons may be specified. Also the salvo launch number may be user controlled. Any one command may not contain both the salvo number and arrival time, however. These direct commands are:

```
FIX (DESIG,GROUP) = (AB123,4)
    (DESIG,GROUP,ARRIVE) = (AD187,6,.5) AND (FA001,92,1)
    (DESIG,GROUP,SALVO) = (FE001,7,1)
```

The first command fixes a weapon from group 4 to target AB123, and downtime is dependent on the time of flight. The second command fixes weapons from groups 6 and 92 to targets AD187 and FA001 with downtimes of .5 and 1, respectively. The third command fixes a weapon from group 7 to target FE001 and the weapon will be launched within the first salvo.

In many cases fixed assignments are made to sets of targets that have sequential DESIGs. In order to capture this often used option, it is permissible for the user to input a string of DESIGs for many targets thereby fixing one weapon group from the indicated weapon group on each target. This command is an expansion on the individual assignment command and is recognized by the appearance of the word DESIG entered twice and separated by a comma. For example:

```
FIX (DESIG,DESIG,GROUP,ARRIVE) = (AB127,AB227,5,1.0)
AND (AB228,AB230,6,1.0)
```

Group 5 will have weapons fixed assigned to all targets starting with DESIG AB127 and ending with DESIG AB227 (101 separate targets). The alpha-portions of these two DESIGs must be equal.

The following constraints apply:

- o No weapons from a bomber group may be fixed on a target which has been allocated more than 30 weapons.
- o No more than 30 weapons may be fixed on an undefended target (MISDEF=0).
- o The number of weapons in any group is the maximum number of fixed assignments which may be made from that group.

2.2.4 The ONPRINTS Adverb. It is not necessary to generate all permissible prints for every PREPALOC execution. For this reason, the ONPRINTS adverb permits the selection of up to four separate print requests numbered 1, 2, 3, or 4. Print request number 1 supplies geographical related reports; request number 2 supplies weapon group related prints; request number 3 prints target data; request number 4 generates target data as modified by user inputs.

The proper print requests follows the ONPRINTS adverb. A series of numbers (in any order) separated by at least a single space turns on the print requests.

Options 3 and 4 produces prints concerning the available target list. If desired, the user may request a subset of targets to be printed by specifying the first and last target. This is possible through the use of special operators comma (,) and dash (-). After the number 3 or 4 the starting target number to be printed will follow the comma operator and the last target number to be printed will follow the dash operator. Consider the command:

ONPRINTS 2 3,10-1297 4,1000

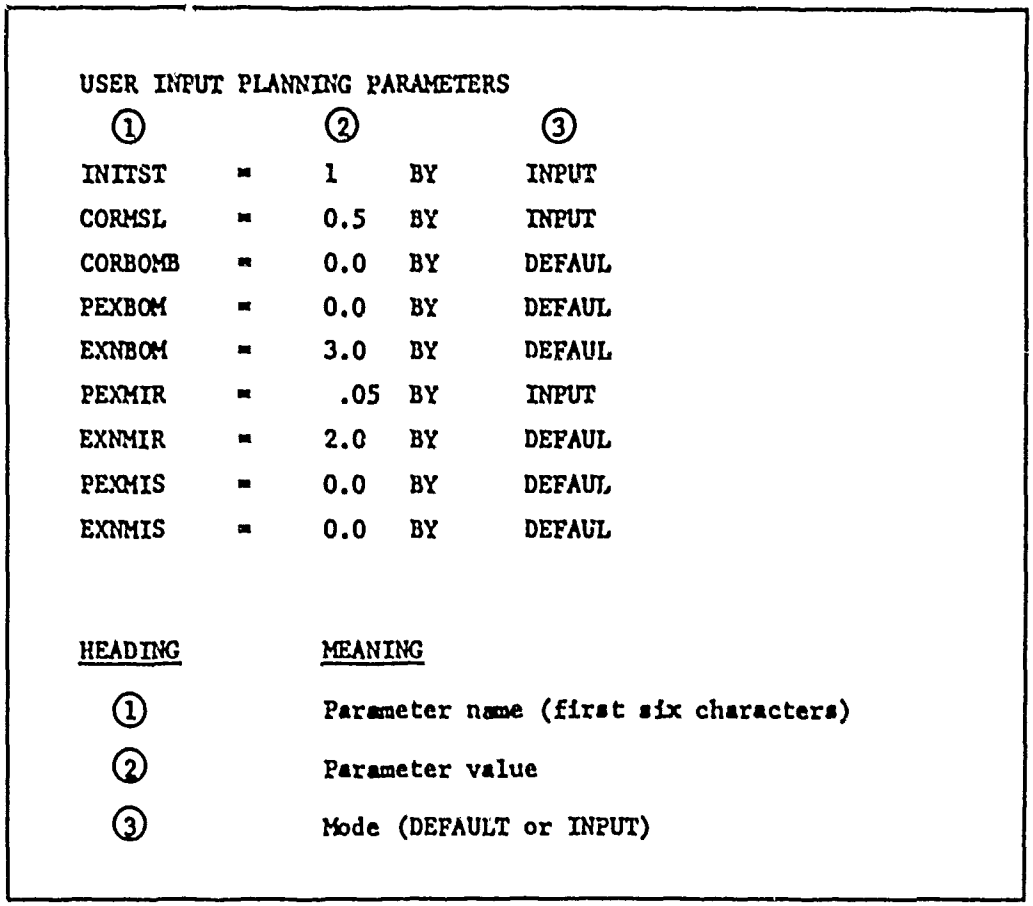
Prints for option two will be generated; target data for target numbers between 10 and 1297 will be generated for option three; and target data for target numbers between 1000 and the maximum value will be generated for option four. If the comma operator is missing print begins with target number one.

2.3 Output

2.3.1 Standard Reports. Standard prints consist of a summary of user selected parameters (figure 3); a target data summary (figure 4) and a summary of fixed assignments (figure 5).

2.3.2 Optional Reports. Reports generated for print option one are given in figures 6 through 12; figure 13 for option two; figure 14 and 15 for option three; and figure 16 for option four.

2.3.3 Error Messages. All possible error messages produced for PREPALOC are explained in figure 17.



USER INPUT PLANNING PARAMETERS

①		②		③
INITST	=	1	BY	INPUT
CORMSL	=	0.5	BY	INPUT
CORBOMB	=	0.0	BY	DEFAUL
PEXBOM	=	0.0	BY	DEFAUL
EXNBOM	=	3.0	BY	DEFAUL
PEXMIR	=	.05	BY	INPUT
EXNMIR	=	2.0	BY	DEFAUL
PEXMIS	=	0.0	BY	DEFAUL
EXNMIS	=	0.0	BY	DEFAUL

HEADING	MEANING
①	Parameter name (first six characters)
②	Parameter value
③	Mode (DEFAULT or INPUT)

Figure 3. Standard Print of User-Input Parameters

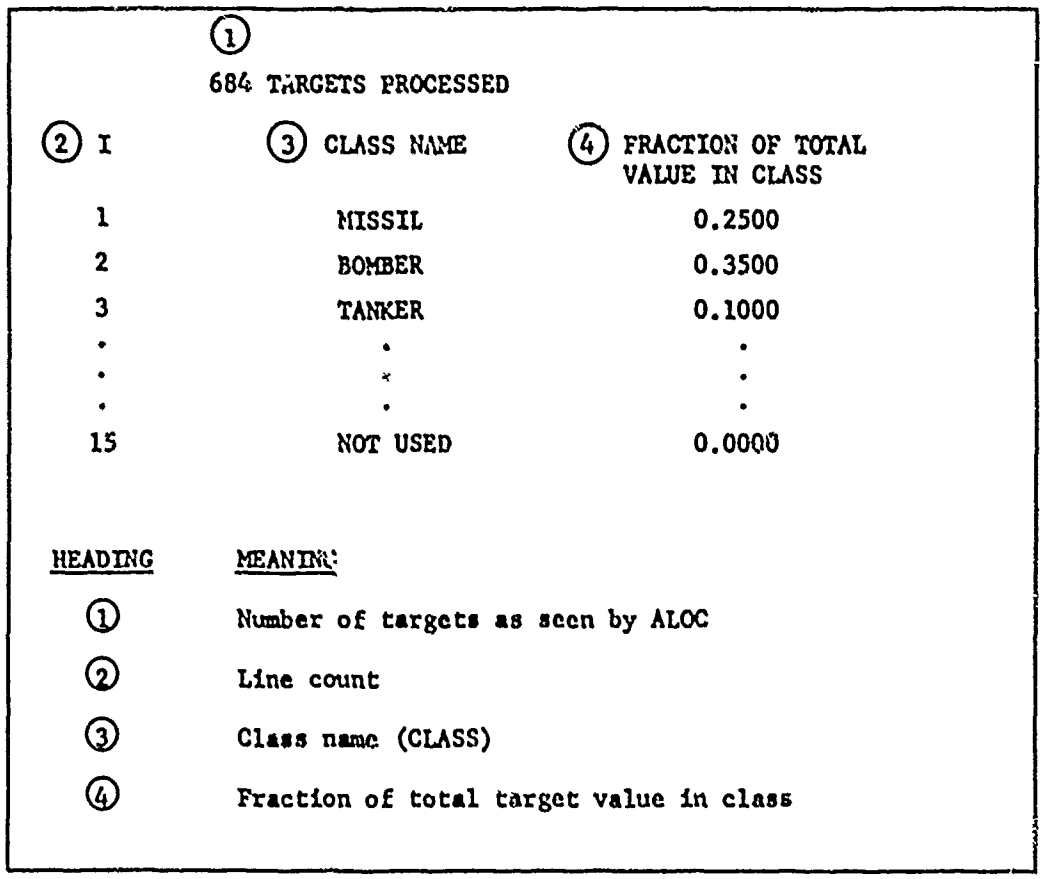


Figure 4. Standard Target Data Summary Print

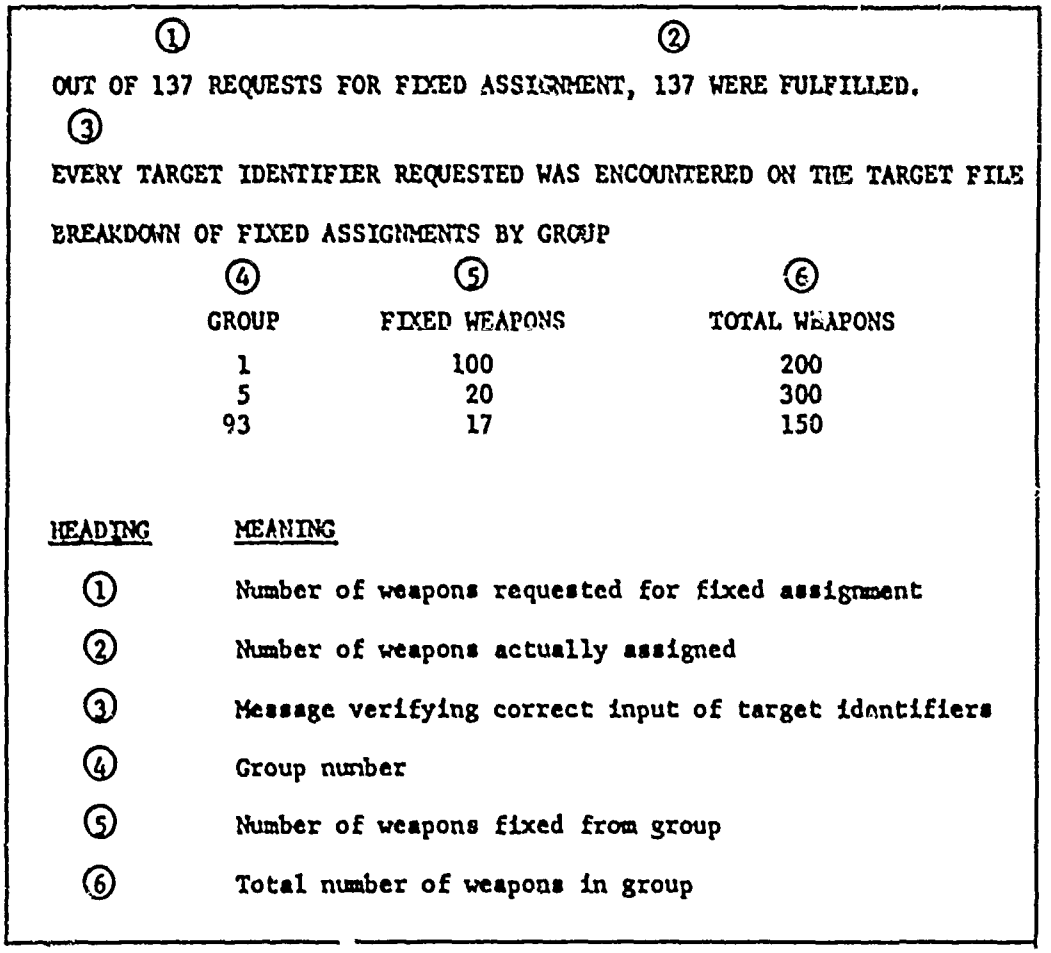


Figure 5. Summary of Fixed Assignment Information

PENETRATION CORRIDOR DATA

① CORNUM	② LAT	③ LONG	④ KORSTY	⑤ HILOAT	⑥ DEFRAN	⑦ ATTRSU	⑧ ATTRCO
1	29.0	217.1	5.0	3.0	250.0	.0001	.0005
2	13.5	105.2	2.0	3.0	250.0	.0002	.0010

⑨ DOGLEG	⑩ LAT	⑪ LONG	⑫ ATTRE
1	62.	172.	0.
4	60.	230.	.0001

HEADING	MEANING
①	Penetration corridor number
②	Latitude of corridor axis orientation point
③	Longitude of corridor axis orientation point
④	Exponent for definition of curvilinear coordinates (attribute KORSTY in data base)
⑤	Ratio of high altitude attrition to low altitude attrition
⑥	Characteristic distance defining rate of change from suppressed attrition to normal attrition
⑦	Attrition probability per nautical mile (suppressed)
⑧	Attrition probability per nautical mile (normal)
⑨	Dogleg associated with Corridor. Direction is outward from the targets. Order is in increasing attribute DOGLEG sort (does not have to be sequential).
⑩	Latitude of dogleg
⑪	Longitude of dogleg
⑫	Attrition in dogleg

Figure 6. Print Option 1: Penetration Corridor Data Print

① CORNUM	② DISTBC	③ ATTRBC
1*	0	0
2*	0	0
3	5.0722E 02**	0
4	0	0
5	0	0

HEADING	MEANING
①	Penetration corridor number
②	Length of corridor (nautical miles) (from entry to origin)
③	Attrition in corridor

* The values for corridors 1 and 2 are irrelevant, since these are the "dummy" corridors for tactical aircraft and aircraft with a value greater than zero for the attribute PKNAV.

** The E format is mathematical base 10 notation. The number w.mmEyy is equivalent to w.mm x 10YY. For example, 5.0722E02 represents 507.22 (i.e., 5.0722 x 100).

Figure 7. Print Option 1: Penetration Corridor Data Print -- Corridor Distance and Attrition

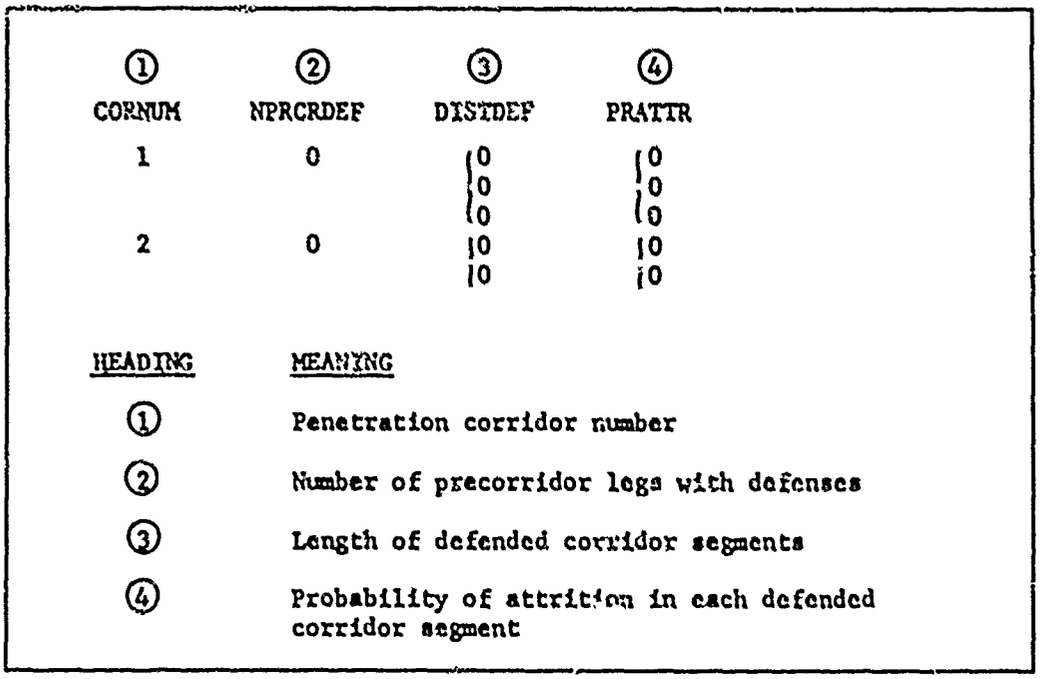


Figure 8. Print Option 1: Penetration Corridor Data Print -- Precorridor Defenses

DEPENETRATION CORRIDOR DATA

① CORNUM	② RECOVERY BASES		
1	AB102	AB196	AC123

③ DOGLEG	④ LAT	⑤ LONG
1	43.0	222.0

HEADING	MEANING
①	Depenetration corridor number
②	DESIG(s) of recovery bases permitted for this corridor (maximum of 4)
③	Dogleg for this corridor. Direction is away from the target
④	Latitude of dogleg
⑤	Longitude of dogleg

Figure 9. Print Option 1: Depenetration Corridor Data

① CORNUM	② DISTEG	③ DISTEF
1	0	0
2	0	0
3	0	0
4	0	0

HEADING	MEANING
①	Depenetration corridor number
②	Length of depenetration corridor (nautical miles from entry to end)
③	Distance from depenetration corridor entry point to recovery point (nautical miles)

Figure 10. Print Option 1: Depenetration Corridor Distance

DEPENETRATION CORRIDOR - RECOVERY BASE LINKING

① DEPENETR CORRIDOR	② BASE ORDER	③ BASE LATITUDE	④ BASE LONGITUDE	⑤ BASE NAME	⑥ BASE CAPACITY	⑦ BASE DISTANCE
1	1	41.0	210.0	AB1	10	100.0
	2	41.2	210.0	AB5	20	200.0
	3	41.3	215.1	AB10	30	300.0
	4	0	0	0	0	0
2	1	36.2	215.3	AB2	60	0.0
	2	37.5	215.4	AB3	50	50.0

HEADING	MEANING
①	Depenetration corridor number
②	Order of base according to increasing distance from end of depenetration corridor
③	Base latitude
④	Base longitude
⑤	Base name
⑥	Base capacity (number of aircraft)
⑦	Base distance from end of depenetration corridor (nautical miles)

Figure 11. Print Option 1: Recovery Base Data Print -- Depenetration Corridor - Recovery Base Linking

REFUEL POINTS

① POINT NO.	② LATITUDE	③ LONGITUDE
1	21.2	212.2
2	31.3	212.3

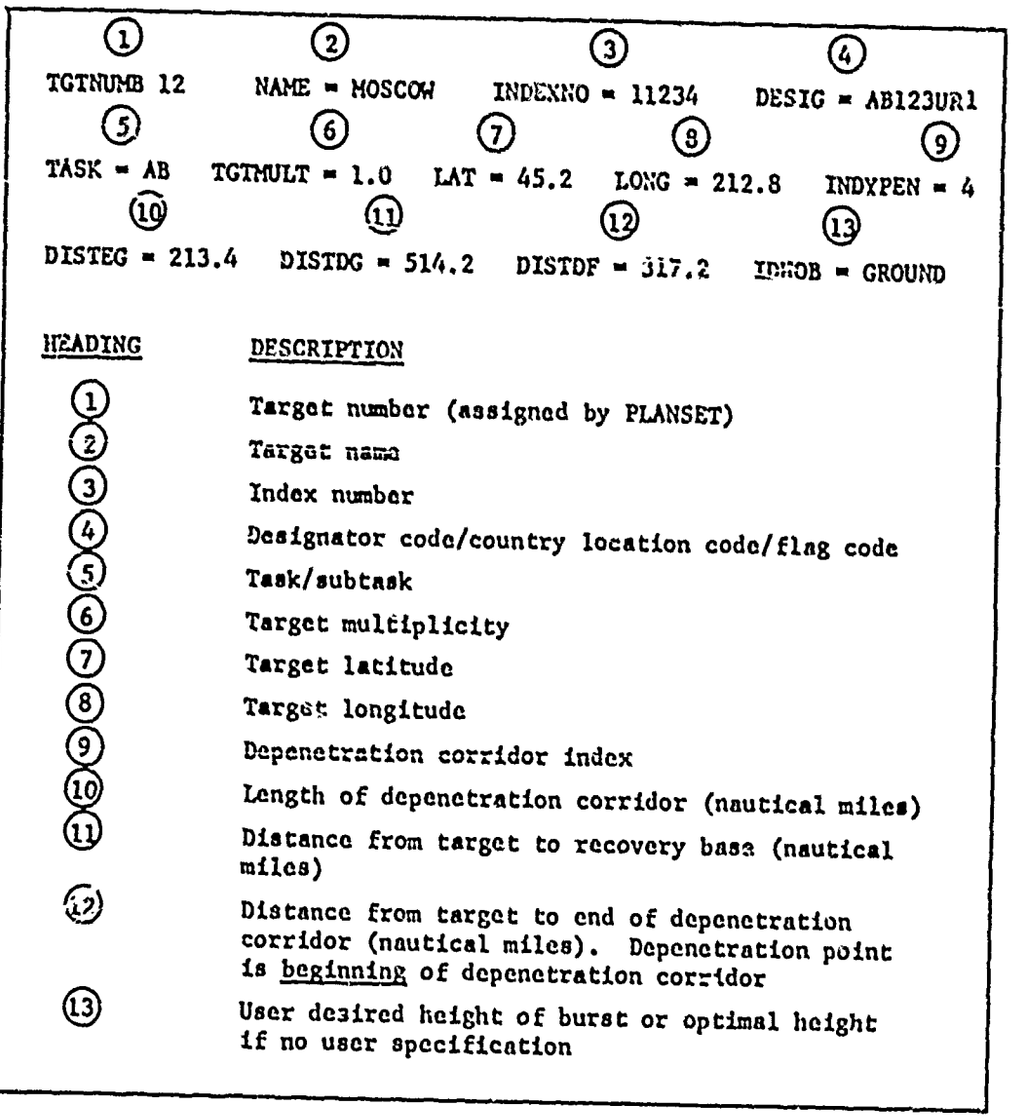
HEADING	MEANING
①	Refuel area number
②	Latitude of refuel point
③	Longitude of refuel point

Figure 12. Print Option 1: Refuel Point Data Print

① GROUP	② CORNUM	③ DISTAC
1	1	0.000
	2	0.000
	3	2931.083
	4	4763.809
	5	5187.943
	6	3516.968
	7	3843.813
	8	4461.455
	9	4860.476
	10	3346.476
	11	3706.963
2	1	0.000

HEADING	MEANING
①	Weapon group number (1-250)as assigned by module PLANSET
②	Corridor index number (column 1 of Penetration Corridor Prints)
③	The great circle distance from the centroid of the weapon group to the penetration corridor entry point in nautical miles

Figure 13. Print Option 2: Weapon Group to Penetration Corridor Distance Print



HEADING	DESCRIPTION
①	Target number (assigned by PLANSET)
②	Target name
③	Index number
④	Designator code/country location code/flag code
⑤	Task/subtask
⑥	Target multiplicity
⑦	Target latitude
⑧	Target longitude
⑨	Depenetration corridor index
⑩	Length of depenetration corridor (nautical miles)
⑪	Distance from target to recovery base (nautical miles)
⑫	Distance from target to end of depenetration corridor (nautical miles). Depenetration point is beginning of depenetration corridor
⑬	User desired height of burst or optimal height if no user specification

Figure 14. Print Option 3: Target Information Print--Part A

① ICORR	② DISTCD	③ ATTRCD
1	0	.0001
2	0	.0002
3	201.4	.0005

HEADING	MEANING
①	Penetration corridor number
②	Distance corridor origin to target (nautical miles)
③	Attrition parameter, corridor origin to target (this value is used as the exponent in the attrition probability calculation).

Figure 15. Print Option 3: Target Information Print--Part B

①	②	③	④	⑤	⑥	⑦
TGTNUM	TGTNAME	INDEXNO	DESIG	INCLASS	TYPE	VALUE
5	MOSCOW	2131	AB123UR1	U/I	RCITY	21.4

⑧	⑨	⑩	①
MINKILL	MAXKILL	VULN	TGTNUM
0.50	0.75	06P0	5

⑪	⑫	⑬
GROUP	ARRIVE	SALVO
94	1.0	5
13	1.0	1

HEADING	MEANING
①	Target number
②	Target name
③	Index number
④	Designator code/country location code/flag code
⑤	Target class name
⑥	Target type name
⑦	Target value
⑧	Target minimum required destruction fraction
⑨	Target maximum desired destruction fraction
⑩	Target vulnerability; for a complex, VULN is the hardest vulnerability in the complex
⑪	If target has fixed assignments, weapon group numbers are listed
⑫	Time of arrival for missile weapons (in minutes from H-hour)
⑬	Salvo number of fixed assignments

Figure 16. Print Option 4: Planning Factor Changes

1	MORE THAN (I4) TARGET CLASS HEADERS. EXCESS IGNORED. PREPALOC has found more than 15 target classes in the data base. Review data base entries.
2	MORE THAN (I5) TARGET TYPES The summation of unique target types over all target classes exceeds the upper bound. Review data base entries.
3	MORE THAN (I5) WEAPON TYPES IN DATA BASE PREPALOC has found more than 100 weapon types in the data base. Review data base entries.
4	MORE THAN (I5) WEAPON GROUPS PREPALOC located more than the maximum number of weapon groups.
5	UNKNOWN INPUT IN ONPRINTS CLAUSE (O12) REST OF CLAUSE IGNORED Check text English syntax.
6	PRINT OPTION (F4.1) DOES NOT EXIST PREPALOC received on unknown print number request.
7	UNKNOWN ADVERB NO. (I4) ENCOUNTERED. ADVERB IGNORED. Check the adverbs in the input command. The only adverbs allowed are SETTING, FIX and ONPRINTS.
8	NO. OF PENETRATION CORRIDORS. EXCEEDED MAX IN PENROUT PREPALOC has found more than 30 penetration corridors in the data base.
9	NO. OF DEPEN. CORR. EXCEEDED MAX IN PENROUT PREPALOC has found more than 50 depenetration corridors in the daba base.
10	DEPROUT ENCOUNTERED NONEXISTENT DESIG FOR RECOVERY BASE (A6) DEPENETRATION CORR: (I5) PREPALOC has encountered a nonexistent DESIG while processing depenetration corridors. Review data base entries.

Figure 17. PREPALOC Error Messages (Part 1 of 5)

11 FACTORCG ENCOUNTERED UNKNOWN ALPHANUMERIC INPUT ATTRIBUTE (I4) CHANGE REQUEST IGNORED. (LAST CHANGE PROCESSED: (O12),(O12))

Check text English for proper syntax.

12 LAST CHANGE REQUEST OUT OF RANGE. CHANGE REQUEST FOR FACTOR NO. (I3) CHANGED TO (F5.1)

PREPALOC received a user change request that was either negative or greater than 1 (for MAXKILL or MINKILL). The change request is adjusted to 0 or 1 respectively.

13 FACTORCG ENCOUNTERED UNKNOWN NUMERIC INPUT ATTRIBUTE (I4) CHANGE REQUEST IGNORED. (LAST CHANGE PROCESSED: (O12),(O12))

Check text English for proper syntax.

14 FACTORCG ENCOUNTERED UNKNOWN INSTRUCTION CODE (I5) ALL FURTHER REQUESTS IGNORED. (LAST CHANGE PROCESSED: (O12),(O12))

Check text English for proper syntax.

15 FACTORCG RECEIVED CHANGE REQUEST FOR NONEXISTENT DESIG (A6) CHANGE REQUEST IGNORED.

PREPALOC has received a nonexistent DESIG in a change request. If the indicated DESIG should exist, consult a maintenance programmer.

16 FACTORCG RECEIVED CHANGE REQUEST FOR NONEXISTENT CLASS (A6) CHANGE REQUEST IGNORED

Check the spelling of the indicated CLASS within text English.

17 FACTORCG RECEIVED CHANGE REQUEST TO CHANGE FACTOR NO. (I4) WITH CRITERION IREG. REQUEST IGNORED

PREPALOC received a request to change a factor other than height of burst for attribute IREG.

18 FACTORCG RECEIVED CHANGE REQUEST TO CHANGE FACTOR NO. (I4) WITH CRITERION IREG. REQUEST IGNORED

PREPALOC received a request to change a factor other than height of burst for attribute IREG.

Figure 17. (Part 2 of 5)

19 FACTORCG RECEIVED CHANGE REQUEST WITH NONEXISTENT IREG (F8.3) CHANGE REQUEST IGNORED

PREPALOC could not find the indicated region in the data base. If the indicated IREG is correct, consult a maintenance programmer.

20 FACTORCG RECEIVED CHANGE REQUEST FOR NONEXISTENT TYPE (A6) CHANGE REQUEST IGNORED

Check the spelling of the indicated type within text English.

21 FIXWEP ENCOUNTERED UNKNOWN ALPHANUMERIC ATTRIBUTE NO. (I5) ALL FURTHER FIX ASSIGNMENTS IGNORED. (LAST FIX ASSG. PROCESSED: (A5),(I5))

Check the syntax of the FIX clause.

22 FIXWEP ENCOUNTERED UNKNOWN INSTRUCTION CODE (I5) ALL FURTHER FIX ASSIGNMENTS IGNORED. (LAST FIX ASSG. PROCESSED: (A5),(I5))

Check the syntax of the FIX clause.

23 FIXWEP ENCOUNTERED UNKNOWN NUMERIC ATTRIBUTE NO. (I5) ALL FURTHER FIX ASSIGNMENTS IGNORED. (LAST FIX ASSG. PROCESSED: (A5),(I5))

Check the syntax of the FIX clause.

24 FIXWEAP RECEIVED BOTH ARRIVAL AND SALVO SPECIFICATION. SALVO SPECIFICATION IGNORED. LAST FIX ASSG. PROCESSED (A5),(I5)

A fixed assignment may honor a downtime or salvo number request; but not both.

25 FIXWEP RECEIVED (A6) (A6) FOR BEGINNING AND END OF STRING OF DESIGS. ALPHA PARTS UNEQUAL. REQUEST IGNORED.

If the option which allows a string of DESIGs to be specified is used, the alpha-portions of the two DESIGs entered must be equal.

26 FIXWEP RECEIVED (A6) (A6) FOR BEGINNING AND END OF STRING OF DESIGS. END DESIG LESS THAN BEGINNING. REQUEST IGNORED.

If the option which allows a string of DESIGs to be specified is used, the numeric-portion of the second DESIG entered must be greater than or equal to that of the first DESIG entered.

Figure 17. (Part 3 of 5)

27 FIXWEP RECEIVED NONEXISTENT DESIG (A6) FIX ASSIGNMENT IGNORED

There is no target with the indicated DESIG in the data base. If there should be, consult a maintenance programmer.

28 FIXWEP RECEIVED NO. TO NONEXISTENT GROUP (I5) FIX ASSIGNMENT IGNORED

No weapon group with the indicated group number exists in the data base.

29 FIXWEP RECEIVED FIX ASSIGNMENT FOR BOMBER GROUP (I5) ON TARGET ALLOCATED MORE THAN 30 WEAPONS. TARGET: (A6) REQUEST IGNORED

No weapons from a bomber group may be fixed on a target which has been allocated more than 30 weapons.

30 FIXWEP RECEIVED FIX ASSIGNMENT ON UNDEFENDED TARGET (A6) WITH MORE THAN 30 WEAPONS ALLOCATED. REQUEST IGNORED

No more than 30 weapons may be fixed on an undefended target (attribute MISDEF equal zero).

31 FIXWEP RECEIVED FIX ASSIGNMENT FOR TARGET (A6) FROM GROUP NO. (I4) WHICH HAS ALL ITS WEAPONS FIXED. REQUEST IGNORED

All weapons from the indicated group have been fixed.

32 LAUNCH TIME NEGATIVE FOR GROUP = (I3) IMPACT TIME = (F10.5) DESIG = (A6)

In fix assigning indicated group a negative launch time was found. The fixed assignment will be honored for the first salvo.

33 NO. OF COUNTRY LOCATION CODES EXCEEDS MAX

PREPALOC found more than 150 country location codes in the data base. Consult a maintenance programmer.

34 IGOT LT TGTMULT,MYSAL: (I6) NSHIFT (I6) IGOT (I6) DESIG = (A6) GROUP = (I3)

The number of salvoed weapons in the salvo indicated by MYSAL is less than the number of fix assignments for this salvo. The next salvo number is attempted.

Figure 17. (Part 4 of 5)

35	MYSAL GREATER THAN MAXIMUM FOR GROUP (I5) DESIG (A6) A fixed assignment with specified downtime generated a salvo number greater than the maximum allowed.
36	SALVO NO. (I3) FULL FOR GROUP (I3) FIX REQUEST IGNORED FOR (A6) Indicated group has used all available salvo slots.
37	LOOPING IN FIXWEF DESIG (A6) GROUP (I5) Cannot locate any available salvo slots for indicated group.

Figure 17. (Part 5 of 5)

SECTION 3. ALOC MODULE

3.1 General Purpose

The major purpose of this module is to determine the optimal allocation of weapons to targets, using a Lagrange multiplier technique. The weapons are divided into weapon groups. A group contains weapons of the same characteristics which are geographically proximate. Thus, weapons are considered identical within groups. Each target is considered individually for weapon assignment. When all targets have been processed, another pass over the targets begins. This process continues until the Lagrange method has allocated all the weapons to the targets. The assignments are then entered in the integrated data base for later processing. The module allows some extent of user control over the allocation process through fixed assignments restrictions on certain weapon groups, and general allocation control parameters.

3.1.1 Modes of Execution. For a given execution of ALOC, several complete passes are made over the target list. During the first pass over the target list many one-time calculations between weapon groups and targets are determined and stored within a data file (called he Weapon/Target Data file). These one-time calculations are continually reread (not recalculated) for each non-first pass over the targets. If there are to be further executions of ALOC and the data base values have not been altered, the created Weapon/Target Data file may be used in lieu of recalculating the one-time calculations. Adverb RECALC (see subsection 3.2) communicates the mode of execution to module ALOC. If RECALC is present, the Weapon/Target Data will be created; otherwise, ALOC assumes the data file to exist.

3.1.1.1 RECALC Mode. In this mode the ALOC module creates the Weapon/Target Data file during the first pass over individual targets. The data contained on the file is then used during successive passes with the file rewound at the outset of each pass. When the file is created the data for it is calculated without reference to any user alterations (for example range modifications) which are input to the ALOC module (there is a parallel file which contains altered data where it is necessary).

3.1.1.2 Non-RECALC Mode. In this mode the ALOC module uses a Weapon/Target Data file created by a previous ALOC run. Experience has shown that many ALOC reruns are due to changes in user directed constraints, data alterations or other changes input to the ALOC module. As noted in 3.1.1.1 above the Weapon/Target Data file is created without reference to these execution time inputs and thus will contain the same data from run to run. The non-RECALC mode takes advantage of this fact by allowing the ALOC module to read the data from the file on pass one as it does on succeeding passes.

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3.1.1.3 Mode Selection and JCL Consideration. The users selects the RECALC mode by including the RECALC adverb in the input. If it does not appear, non-RECALC mode will be assumed. In either case, either a tape or file must be included with a file code of 15. If the user wishes to create a Weapon/Target Data file for use on several runs, an appropriate entry should be made in the JCL for file code 15.

3.1.1.4 Non-RECALC Mode Caution. The user should be aware that indiscriminate use of the non-RECALC mode will cause errors. In general, it is best to run ALOC in the RECALC mode following any change to the basic weapon or target data or if any modules which run prior to ALOC are rerun. For example, the Weapon/Target Data file is not likely to be valid between scenarios so that if module DBMOD is rerun with a new value for the SCENARIO attribute ALOC should be run in RECALC mode.

3.2 Input

The verb ALLOCATE initiates execution of the ALOC module. This verb has 11 optional adverbs which the user may use to control ALOC's functions. These adverbs are:

- FLAGREST — User specifies weapon groups which are restricted according to the setting of the FLAG attribute
- LOCREST — User specifies weapon groups which are restricted according to the country location of the target
- MINRANGE — User specifies changes to a group's minimum range
- MIRVREST — User specifies restrictions to MIRV groups according to target class
- MODRANGE — User specifies modification to the range of groups
- ONPRINTS — User selects desired print option and specifies ranges and frequencies for those prints
- PUNCH — User requests output of final Lagrange multipliers
- READMUL — User specifies values for Lagrange multipliers to be used at the outset of ALOC execition
- RECALC — User specifies that the Weapon Data File must be created by ALOC and not read in
- SETTING — User specifies values for ALOC parameters other than their default values
- SMAT — User specifies values for the SMAT array

The ALOC module will execute properly in the absence of any of these adverbs.

3.2.1 The FLAGREST Clause. This clause specifies interaction between weapon groups and the target attribute FLAG which may have a value of 0-9 inclusive. (A value of 0 indicates that no weapon is restricted from that target because of its flag.) In this clause, the user specifies which groups are restricted and what target FLAG values they may or may not attack. The general form of the FLAGREST clause is

$$\underline{\text{FLAGREST}} \quad \underline{\text{group}} \left[\perp \underline{\text{group}} \cdots \perp \underline{\text{group}} \right] \quad \left\{ \begin{matrix} \underline{\text{INCLUDE}} \\ \underline{\text{EXCLUDE}} \end{matrix} \right\}$$
$$\underline{\text{flag}} \left[\perp \underline{\text{flag}} \cdots \perp \underline{\text{flag}} \right]$$

The adverb may be followed by any number of sets of inputs each consisting of three parts. First a set of one or more group numbers separated by commas are supplied followed by either of the two special words: INCLUDE or EXCLUDE. Third a set of one or more flag numbers separated by commas define entries for attribute FLAG.

The relationship of the group numbers to the flag numbers is specified by the intervening special word. If the word is INCLUDE, then the specified groups are restricted from all but the specified flags. If the word is EXCLUDE, then the specified groups are restricted from the specified flags. For example

FLAGREST 1,2,3 INCLUDE 3,4 5,6 EXCLUDE 7,8

The result of this example would be that groups 1, 2, and 3 could not attack targets where FLAG values were 1, 2, 5, 6, 7, 8, or 9 and groups 5 and 6 could not attack targets where FLAG values were 7 or 8.

3.2.2 The LOCREST Clause. This clause specifies interaction between weapon groups and the country location code of targets. In this clause, the user specifies which groups are restricted and what target country locations they may or may not attack. The general form of the LOCREST clause is:

$$\underline{\text{LOCREST}} \quad \left[\perp \underline{\text{group}} \cdots \perp \underline{\text{group}} \right] \quad \left\{ \begin{matrix} \underline{\text{INCLUDE}} \\ \underline{\text{EXCLUDE}} \end{matrix} \right\}$$
$$\underline{\text{country location}} \left[\perp \underline{\text{country location}} \cdots \perp \underline{\text{country location}} \right]$$

The adverb may be followed by any number of sets of inputs, each consisting of three parts. First a set of one or more group numbers separated by commas are supplied followed by either of the two special words: INCLUDE or EXCLUDE. Third a set of one or more country location codes (i.e., US, UR, etc.) separated by commas are entered.

The relationship of the groups to the country codes is specified by the intervening special word. If the word is INCLUDE, then the specified

groups may not attack any targets but those with the specified country locations. If the word is EXCLUDE, the specified groups may attack only targets whose country locations are other than those given.

An example of a LOCREST clause:

LOCREST 1,2,3 INCLUDE UR,CH 4,5,6,7 EXCLUDE PO,CZ,BU

The result of this example would be that groups 1, 2, and 3 could only attack targets whose country location codes were "UR" or "CH", and groups 4, 5, 6, and 7 could not attack targets whose country codes were "PO", "CZ" or "BU".

3.2.3 The MINRANGE Clause. This clause allows the user to specify a value for the RNGMIN attribute other than that given for a group. The clause consists of a new minimum range value followed by one or more group numbers. Parantheses are optional. The general form is:

MINRANGE (minimum range , group [, group . . . , group])

As many sets of values may appear in a single clause as desired. The user should note that use of this clause alters the value of the RNGMIN attribute for this run of ALOC only and does not alter its data base value in any way. An example of a MINRANGE clause is:

MINRANGE (1000,1,2,3,4) (1500,9,10)

The result would be to set the RNGMIN value to 1000 for groups 1, 2, 3 and 4 and to 1500 for groups 9 and 10.

3.2.4 The MIRVREST Clause. This clause allows the user to specify restrictions for MIRV weapon types. These types may be restricted to particular target classes. In addition to standard classes, they may be restricted to complexes (COMPLE), defended complexes (COMPLD), defended targets (DEFEND) and/or multiple targets (MULTIP).

The general form of the MIRVREST clause is:

MIRVREST (payload name , class [, class . . . , class])

The adverb is followed by any number of sets of values separated by commas. The first value is the name of a MIRV group's payload table. The remaining values are class names of those targets which the indicated group(s) may attack. The parentheses are optional. An example follows.

MIRVREST (MM-III , COMPLE,COMPLD, U/I) (POSEID ,BOMBER)

This effect of this would be to restrict weapons with the payload table name "MM-III" to complexes (defended or not) and target class "U/I". Further weapons with the payload table name "POSEID" would only be able

to attack single targets of class "BOMBER". Note: Although this option was designed for MIRV weapons, there is no current restriction which would prevent use of this option for non-MIRV weapon systems.

3.2.5 The MODRANGE Clause. This clause allows the user to alter the data base attributes RANGE and RANGEREF for allocation purposes. The values of RANGE and RANGEREF initially stored within the data base are not altered. Module ALOC conducts the allocation with the user directed multipliers values but this information is not passed to other QUICK processors.

The user supplies multipliers for RANGE and RANGEREF on a weapon group basis. The general form is:

MODRANGE (range multiplier [/ refuel range multiplier]
⊥ group [⊥ group . . . ⊥ group])

The clause consists of any number of sets of values. The first value of the set is a multiplier for the RANGE attribute which is followed by the optional slash (/) and a multiplier for the RANGEREF attribute. Following the multipliers are the group numbers to which the multipliers are applicable. Each group number must be preceded by a comma. Numeric sets of multipliers may be defined by leaving at least one space between each data set.

If the multiplier for RANGEREF is omitted it is treated as the same as that for RANGE.

An example of a MODRANGE clause would be:

MODRANGE (.8/.9,1,2,3) (.7,4,5)

The effect would be to multiply the RANGE attribute by .8 and the RANGEREF attribute by .9 for groups 1,2 and 3. Also, both the RANGE and RANGEREF attributes of groups 4 and 5 would be multiplied by .7.

3.2.6 The ONPRINTS Clause. This clause allows the user to control the appearance of various print options. The options available are detailed in table 2. Each option may be selected and the frequency of its appearance(s) controlled as to the pass and/or targets. The control parameters available and their default settings are:

First pass of appearance - default pass 1.
Last pass of appearance - default pass 9999
First target of appearance- default target 1
Last target of appearance - default target 9999
Frequency of appearance as to target - default every target (1)

In addition, options 1, 2, 4 and 16 are initially selected with the frequency of option 4 set at 50. The user may request that these options not appear. The general form of the ONPRINTS clause is:

Table 2. Description of Print Option Numbers for Program ALOC (Part 1 of 2)

OPTION	DESCRIPTION OF PRINT
1	Input weapon data
2	Main summary prints after weapons have been allocated to target
3	Not used
4	Print for all weapon groups the Lagrange multipliers, the total number of weapons allocated (RNALL), and number of weapons allocated (RNALL), and number of weapons allocated this pass (NALL) with total weapon value and value of error in allocation
5	Print of data on target weights and rates of change of weights
6	Target input data before allocation begins
7	Basic weapon/target interaction data before allocation of weapons to target
8	Risk array before allocation begins on target
9	Summary of weapons assigned to present target and marginal values for each (see option 22 for companion print of potential weapons)
10	Input data to the single target allocator (STALL) -- i.e., output from WAD
11	Initial values for lambdas, VALWPNS and VALERR, at start of module only
12	Debugging print showing synopsis of calculation of actual payoff by WAD
13	Debugging print showing after-the-fact synopsis of potential weapon added and weapon deleted payoff calculations by WAD
14	Not used
15	Not used

Table 2. (Part 2 of 2)

OPTION	DESCRIPTION OF PRINT
16	Defense level and attack mode print for targets with terminal ballistic missile defense
17	Not used
18	Not used
19	Planning factor summary for targets with terminal ballistic missile defenses
20	Summary of WADOUT cost payoff benefit, etc.
21	Complete listing of allocation error estimates (ALLEREST)
22	Summary of marginal payoff data for potential weapons followed by resulting STALL decision: a companion print to print number 9
23	Printout of timing information
24	Memory dump and run termination
25	List of inactive switches for each weapon group as related to current target
26	Print of preferred corridors and computed penetration probabilities for each penetration corridor for all bomber groups relative to current target; available only on first pass
27	Best rate of return for missile allocation in DEFALOC
28	Debugging print of allocations and payoff computed in RESVAL
29	Print of Lagrange multiplier, balance parameter, and stockpile for salvoed missiles
30	Print of bomber payload indicators and allocation fractions

ONPRINTS option [, first target - last target / frequency]
[* first pass - last pass] [NOT option]

This clause has a number of optional forms. Following the adverb the user may input any number of sets of values in various forms. A single number (in the range 1-30, see table 10) will cause that option to appear with default controls. If the user wishes to surpress a default option (i.e., 1, 2, 4, or 16) the option number is preceded by the NOT operator.

User alterations to target control defaults are preceded by a comma. A number following the comma will be used as a first target control. A number preceded by a hyphen will be used as a last target and a number preceded by a slash will be used as a frequency. Only those controls which the user wishes to change need be included. Similarly, the pass controls are preceded by an asterisk.

For example:

ONPRINTS NOT 4 5,50*-2 6,/4

Would cause option 4 to be surpressed, option 5 to appear beginning with target 50 and for passes one and two, and option 6 to have a frequency of 4.

3.2.7 The PUNCH Clause. This adverb allows the user to request that the final Lagrange multiplier be saved on an output unit. The format used for this output is such that it can be assessed on later runs by the READMUL clause. The general form of the PUNCH clause is

PUNCH [NEW = unit number]

The optional portion is used to specify an output unit other than 43 (system punch).

3.2.8 The READMUL Clause. This clause allows the user to specify starting lagrange multipliers for the ALOC module. These multipliers fall into six categories and are all originally set to 1. Through this clause, the user may also specify an input unit created by the punch adverb in a previous run. The general form is

READMUL OLD = unit

[{ALL / CLASS / TYPE / REGION / GROUP / OTHER}, index, lambda value] . . .

The "OLD" phrase gives an input unit created by PUNCH. Each other value is specified by a set of values the first of which is one of the word shown in the form above, the second is an index identified by the first, and the third is the desired starting multiplier. The ALL form should not have an index.

3.2.9 The RECALC Clause. This clause consists only of the adverb RECALC. By including this adverb the user indicates that there is no Weapon/Target Data file available from a previous ALOC execution. This adverb should be included, therefore, on any run where no such file exists from a previous run or where alterations in the weapon or target data have rendered the information on the available file invalid.

3.2.10 The SETTING Clause. This clause is a standard SETTING clause applied to the allocation parameters identified in table 3. The default values for these parameters is shown in table 3 also. The user may not alter any attributes other than these parameters via this clause. For example:

```
SETTING BPENFAC=1 SNSTYTY=.05 PKTX=.95
```

3.2.11 The SMAT Clause. Through this clause the user enters and/or saves values for the SMAT array. The row and column labels for this array and their meaning is shown in table 4. The clause consists of a series of labels and values separated by commas. Each J Index label encountered causes this index to be set. Each I index label has a similar function. When a value is encountered it is entered in the array at the current setting of the I and J indexes. To cause the settings to be permanently entered for later runs the user follows the adverb with the special word UPDATE. An example which would set the SMAT array as per the defaults shown in table 5 would be:

```
SMAT UPDATE ALL,SBL,0,CC,OREL,0,PEN,0,STK,0,GROUP,0,REGION,0,
' CLASS,0,TYPE,0,ALERT,0,PEN,0 REL,0.CC,0,SBL,0,TYPE,.1,CLASS,.4,
  REGION,.1,GROUP,.1,CC,.2,REL,.05,PEN,0,REGION,.1,CLASS,.2,
  TYPE,.2,REL,.2,CC,.1,CLASS,.1,REGION,.3,REL,0,CLASS,.1
```

Each value entered should lie between 0. and 1. and the sum of all elements with the same failure mode index J must be less than or equal to 1.

3.3 Output

3.3.1 Standard Output. The printed output of the ALOC module may be divided into four parts: Input prints, standard allocation prints, detailed prints, and debug prints. Most of these may be controlled via user option selection. Those which are not controlled or which always appear at a certain point will be noted as such.

Table 3. Input Parameter Card Specifications
(Part 1 of 6)

NAME	RANGE	DEFAULT	DESCRIPTION
IMATCH	Standard integer	0	Controls the method used to determine if a weapon allocation has met the required minimum destruction fraction specified by MINKILL. If IMATCH is 0, the calculation of fraction killed includes the time dependence of target value. If IMATCH is not equal to 0, the fraction calculation does not consider time dependence of target value.
TARFAC	≥0.0	0.1	Multiplies the level of terminal bomber defense on each target (TARDEF). Used to increase or decrease all local bomber defenses.
BPENFAC	≥0.0	1.0	Multiplies attrition rates for bomber penetration given in the data base. Normally should be equal to 1.0, but can be used to test alternative assumptions without changing the data base.
PKTX	0.0-1.0	0.0	Probability of missile warhead kill by one terminal ballistic missile defense interceptor.
RADPX	0.0-1.0	0.0	Probability of missile warhead kill by a random area ballistic missile defense.
MINDAMAG	0.0-1.0	0.0	Minimum fraction of original value of a target without terminal ballistic missile defenses that must be destroyed by each weapon allocated to the target. If the default option is not used, this constraint may cause nonconvergence by not allowing ALOC to put down all the weapons. The fix for this case is to reduce MINDAMAG or reduce weapon inventory.
FIXOPT	*TRUE*, *FALSE*,	*TRUE*	Fixed assignment option. If TRUE, fix as in data base in FALSE ignore fix requests.

Table 3. (Part 2 of 6)

NAME	RANGE	DEFAULT	DESCRIPTION
LOWFAC	0.0-1.0	0.0	Multiplier of the nominal level of terminal ballistic missile defense. Represents the lower estimate of the Defense level (see PROBLOW).
PROBLOW	0.0-1.0	0.0	Probability that the level of terminal ballistic missile defense is degraded by the factor LOWFAC; e.g.; if the nominal number of terminal BMD interceptors is MISDEF but there is a 25% probability that the actual level of interceptors is half this large, LOWFAC = .5 and PROBLOW = .25. These factors apply to every target with terminal BMD.
HIGHFAC	≥0.0	0.0	Serves the same function as LOWFAC, except that it represents the upper estimate of terminal ballistic missile capability.
PROBHIGH	0.0-1.0	0.0	Same function as PROBLOW except that it is the probability of occurrence of the upper defense estimate HIGHFAC.
LAW	*SQUAREROOT* or *POWER*		Specifies the form of damage law used on area targets (i.e.; targets with RADIUS >0.0). If it is equal to *SQUAREROOT* the square root damage law is used. Otherwise, the power (or exponential) law is used on area targets.
TINTFAC	≥0.0	1.0	Acts as a multiplier for the number of terminal BMD defense interceptors over the entire target system.
CORR	0.0-1.0	0.5	Acts as a multiplier for the entries in the SMAT array. Decreasing the value of CORR reduces the effect of interweapon correlations. (With the default SMAT array, the value of CORR should not exceed .5 for good results.)

Table 3. (Part 3 of 6)

NAME	RANGE	DEFAULT	DESCRIPTION
CORR2	0.0-1.0	0.0	Optional, to evaluate the final weapon allocation with a different multiplier for the SMAT array values. Used in conjunction with the user-input parameter IVERIFY.
FACMIRV	0.0-1.0	0.0	Modifies the SMAT array for MIRV systems. For weapons with a MIRV capability, the values of the SMAT array corresponding to the GROUP attribute for failure modes SBL, CC, and REL (see table 4) are increased by the produce of FACMIRV and the unassigned variance for those failure modes. (For the default SMAT array, table 5, the unassigned variance for SBL is .30, for CC is .30, and for REL is .65.) Table 6 provides two examples of the SMAT array for MIRV systems: when the default SMAT array is used in conjunction with FACMIRV = 0.5, and when it is used with FACMIRV = 1.0. For examples of this effect of this parameter see table 6.
RINTPRD	>1.0	2.0	Approximate ratio between rate of change of target weights between different integration periods. An increase in this parameter increases the sensitivity of the multiplier adjustment to recent target experience.
RATIOINT	≥0.0	2.0	Ratio of longest integration period used to the theoretical*--a low value allows higher sensitivity without oscillations in the values of the Lagrange multipliers, but too low a value makes convergence to the correct stockpile sensitive to statistics of the target list. If the target list contains targets with heavy ballistic missile defenses or if a large fraction of the weapons is assigned by the fixed assignment capability, this parameter value should be increased (to 4.0 or above if necessary).

Table 3. (Part 4 of 6)

NAME	RANGE	DEFAULT	DESCRIPTION
SNSTVTY	≥0.0	0.1	Controls sensitivity of multiplier adjustment during early phases. Too high a sensitivity can cause oscillations in multipliers. If the parameter RATIOINT is increased, this parameter should be decreased, and vice versa.
FSNSTVTY	≥0.0	1.0	Controls sensitivity of multiplier adjustment during latter part of allocation. If the parameter SETTLE is increased, this parameter should be decreased, and vice versa.
CLOSE	>1.0	1.05	Must be greater than 1.00. Excess over 1.00 determines magnitude of closing force relative to Lagrange multipliers at start of closing phase (PROGRESS = 1.0).
DELTVAL	0.0-1.0	.005	Maximum fractional difference in time-dependent target value permitted in the same time-of-arrival cell. (Will be automatically increased in available cells are exceeded -- a high value allows slightly faster operation -- a low value increases accuracy of time-of-arrival calculations.)
PRM	0.0-1.0	.5	Controls value of quadratic premium before PROGRESS = 1.0. Must lie between 0 and 1.0. Higher values give more stable performance.
STALADJ	0.0-1.0	.5	Determines extent to which STALL favors high unit profit versus efficiency in selecting weapons for initial laydown of each target. Should be adjusted to minimize IOPS for run, so long as it does not adversely affect total payoff.
CLOSER	≥0.0	4.0	Controls rate of increase in CLOSE or closing force per pass over target system. High values will close allocation to exact stockpile more rapidly but will cost more in payoff to do so.

Table 3. (Part 5 of 6)

NAME	RANGE	DEFAULT	DESCRIPTION
QUALITY	0.0-1.0	0.5	Controls extent to which STALL will attempt to refine allocation for each target. Should be set as low as possible for fast operation, so long as total payoff is not reduced. In cases tried so far, half refinement works well; but this should not be assumed.
IVERIFY	0, 1, 2	0	Controls the operation of the allocator after the final weapon allocation has been determined. A value of 0 is used to terminate processing at this phase. A value of 1 will verify the optimality of the payoff by processing another pass through the target list (called the verification pass) with no premiums and the values of the Lagrange multipliers frozen at their final weapon allocation values. The differences in profit between the end of the weapon allocation and the end of the verification pass is a strict upper bound on the difference between the payoff at the end of weapon allocation and the optimal payoff. A value of 2 for IVERIFY is used to evaluate the final weapon allocation using the value of CORR2 in place of CORR as the SMAT array multiplier.
SETTLE	>0.0	1.0	Controls the number of passes at PROGRESS = .75 before PROGRESS is set to 1.00 and closing begins. Larger numbers give more exact multipliers. However, 1.00 usually is quite adequate. A value of SETTLE less than 1.00 can yield a very suboptimal allocation if defective allocations prior to PROGRESS = .75 are not replaced in closing (see parameter FSNSTVTY).

Table 3. (Part 6 of 6)

NAME	RANGE	DEFAULT	DESCRIPTION
ERRCLOS	0.0-1.0	.001	Provides one control of the termination of weapon allocation processing (ALLOCATE function). If VALERR < VALWPNS * ERRCLOS, where VALERR is the absolute value of the sum of the Lagrange multipliers for all under-or-over-allocated weapons, and VALWPNS is the sum of the Lagrange multipliers for all weapons in the stockpile, then the weapon allocation process will terminate normally. The complete set of normal terminating conditions for this function is described in the Termination of ALLOCATE Function.

Table 4. Acceptable Values for SMAT Array Indices

J Index. Failure Modes

J	MNEMONIC	DESCRIPTION
1	SBL	Survival before launch
2	CC	Reliability of command and control system
3	REL	Weapon system hardware reliability
4	PEN	Penetration probability
5	STK	Probability of target kill by warhead

I Index. Weapon Attributes

I	NAME	DESCRIPTION
1	ALL	Shared by all weapons in the stockpile
2	GROUP	Weapons of same class, type, region, and alert status whose launch bases are close to one another
3	REGION	Region of launch base
4	CLASS	Weapon class, either bomber or missile
5	TYPE	Weapon type (e.g., B-52G, Poseidon)
6	ALERT	The alert status of the weapon, either alert or nonalert

Table 5. Default Values for SMAT Array

		ATTRIBUTES					
	I =	1	2	3	4	5	6
	J	ALL	GROUP	REGION	CLASS	TYPE	ALERT
	1 SBL	0	.10	.10	.40	.10	0
FAILURE	2 CC	0	.20	.30	.10	.10	0
	3 REL	0	.05	0	.10	.20	0
MODES	4 PEN	0	0	.10	.20	.20	0
	5 STK	0	0	0	0	0	0

Table 6. SMAT Array for MIRV Systems
(FACMIRV = 0.5 and FACMIRV = 1.0)

FACMIRV = 0.5

ATTRIBUTES

		ALL	GROUP	REGION	CLASS	TYPE	ALERT
	SBL	0	.25	.10	.40	.10	0
FAILURE	CC	0	.35	.30	.10	.10	0
	REL	0	.38	0	.10	.20	0
MODES	PEN	0	0	.10	.20	.20	0
	STK	0	0	0	0	0	0

FACMIRV = 1.0

ATTRIBUTES

		ALL	GROUP	REGION	CLASS	TYPE	ALERT
	SBL	0	.40	.10	.40	.10	0
FAILURE	CC	0	.50	.30	.10	.10	0
	REL	0	.70	0	.10	.20	0
MODES	PEN	0	0	.10	.20	.20	0
	STK	0	0	0	0	0	0

3.3.1.1 Input Prints. These prints are of two types. First the input parameters, print options and group restrictions are produced as a standard uncontrolled print at the outset of the execution. Included in this point is timing information concerning the data input process. The display of flag, location, and MIRV restrictions, and range modifications appear only if there was user input of that kind. This print is illustrated in figure 18.

The second input print is controlled as option 1 but appears only for the first target and first pass. This print displays basic weapon group data and is shown in figure 19.

3.3.1.2 Standard Allocation Prints.

3.3.1.2.1 Detailed Weapon Allocation Data. These prints (print options 2 and 16) display the allocation to each target as the target is processed. Figures 20 and 21 display these prints. The print displayed in figure 20 is print number 16 and appears only preceding data for targets with terminal ballistic missile defenses. The quantities:

DPROFIT - PROFIT - OPROFIT

SDPROFIT = DPROFIT

DELTEFF = DPROFIT/VALWPNS

SDELTEFF = SDPROFIT/VALWPNS

require some explanation. These quantities are computed and the latter two are printed out in the standard option 2* to help the user in evaluating the progress of the allocation. The quantity OPROFIT represents the "profit" of the old allocation to the target evaluated in terms of the present values of the Lagrange multipliers. DPROFIT is thus a measure of the improvement in profit using the new allocation. Up until PROGRESS = 1.0 this quantity is summed over all targets (one complete pass only), to give SDPROFIT. Thus when the multipliers have been near the correct values for one full pass the value of SDPROFIT should be small. To provide a standard relative value for interpreting these quantities, they are divided by the value of all weapons VALWPNS,**

$$VALWPNS = \sum NWPNS(G) * LAMEF(G)$$

to obtain DELTEFF and SDELTEFF which measure changes in profit as a fraction of the total value of all weapons.

---

* See column labeled (P-O)/VWPS in this print, headings 17 and 27 in figure 21.

** The value of NWPNS does not include the weapons fixed by the user.

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Figure 18. ALOC Input Print (Part 1 of 4)

HEADING	LABEL	DESCRIPTION
(1)		Appears only when ALOC module is in RECALC mode
(2)		ALOC parameters for this run
(3)	SMAT ARRAY	SMAT array values used for this run
(4)	MODIFIED RANGES	Appears only in case of user input of MODRANGE or MINRANGE clause
(5)	GROUP	Number of group
(6)	RANGEMOD	Multiplier for group's RANGE attribute
(7)	REFRNG MOD	Multiplier for group's RANGEREF attribute
(8)	MINRANGE	Replacement value for group's RNGMIN attribute. A value of zero indicates no replacement
(9)	FLAG RESTRICTIONS	Appears only in case of user input of FLAGREST clause
(10)	GROUP	Number of group
(11)	DENIED FLAGS	Value of FLAG attribute for targets group may not attack
(12)	COUNTRY RESTRICTIONS	Appears only in case of user input of LOCREST clause
(13)	GROUP	Number of group
(14)	DENIED COUNTRIES	Value of CNTRYL attribute for targets group may not attack
(15)	MIRV RESTRICTIONS	Appears only in case of user input of MIRVREST clause
(16)	MIRV	Payload table name of MIRV

Figure 18. (Part 2 of 4)

HEADING	LABEL	DESCRIPTION
(17)		Class Names of targets MIRV system may attack
(18)	PRINT REQUESTS	Active print option
(19)	OPTION	Option number
(20)	FIRST	First pass of appearance
(21)	LAST	Last pass of appearance
(22)	FIRST	First target of appearance
(23)	LAST	Last target of appearance
(24)	FREQ.	Frequency of appearance
(25)	--	Timing information for function of first overlay
(26)	INITIALIZE	Initialization function in INITAL
(27)	OPTS/SMAT	Time spent reading SMAT and/or SETTING clauses
(28)	FLAG/LOC	Time spent reading FLAGREST and/or LOCREST clauses
(29)	MIRVREST	Time spent reading MIRVREST clauses
(30)	PUNCH	Time spent reading PUNCH clause
(31)	PRINT OPTS	Time spent reading ONPRINTS clause
(32)	READML	Time spent reading READMUL clause

Figure 18. (Part 3 of 4)

HEADING	LABEL	DESCRIPTION
(33)	RANGEALT	Time spent reading MODRANGE and/or MINRANGE clauses
(34)	DATGRP	Time spent in subroutine DATGRP
(35)	MISC.FUNCT.	Time spent not accounted for in (26) - (34)
(36)	ACTIVE TIME	Total of (26) - (35)

Figure 18. (Part 4 of 4)

①	② NWPNS	③ WLAT	④ WLONG	⑤ IREG	⑥ LTYP	⑦ ALRT	⑧ SRL	⑨ IREF	⑩ YIELD	⑪ RANGE	⑫ CEP	⑬ SPEED	⑭ ALRTDL	⑮ NLRTDL	⑯ RDEC	⑰ ICLS	⑱ RANGEREF	⑲ REL	⑳ CC
1	72	40.50	91.50	1	2	1	0.79	-5	1.75	4800.00	0.50	510.00	0.00	6.00	3.0	2	6300.00	0.90	1.00
2	80	40.50	91.50	1	2	2	0.17	-5	1.75	4800.00	0.50	510.00	0.00	6.00	3.0	2	6300.00	0.90	1.00
3	72	33.50	97.50	1	2	1	0.79	-5	1.75	4800.00	0.50	510.00	0.00	6.00	3.0	2	6300.00	0.90	1.00
4	80	33.50	97.50	1	2	2	0.17	-5	1.75	4800.00	0.50	510.00	0.00	6.00	3.0	2	6300.00	0.90	1.00
5	50	48.50	100.50	1	1	1	0.90	11	1.00	4700.00	1.00	1200.00	0.00	0.00	1.1	1	0.00	0.70	1.00

㉑ TOTAL WEAPONS = __

HEADING	LABEL	DESCRIPTION
①		Weapon group number
②	NWPNS	Number of weapons in group (not fixed by the user). {This includes weapons which had RNGMOD and LAUNCH set to zero.
③	WLAT	Latitude of group centroid
④	WLONG	Longitude of group centroid
⑤	IREG	Index of command and control region for group
⑥	LTYP	Weapon type index (LTYPE from program PLANSET)
⑦	ALRT	Weapon alert status: 1=alert; 2=nonalert
⑧	SRL	Probability of weapon survival before launch
⑨	IREF	Weapon refuel code for bombers; vehicle payload index for missiles
⑩	YIELD	Mean yield of weapons in group (megatons)
⑪	RANGE	Unrefueled range of vehicles (nautical miles)[disregarding modifications made in RANGEMOD option]
⑫	CEP	Probable circular error of weapon vehicle (nautical miles)
⑬	SPEED	Vehicle bomber speed (knots); for missiles, minimum time of flight (hours)
⑭	ALRTDL	Delay of alert vehicles before commencing launch (hours)
⑮	NLRTDL	Delay of nonalert vehicles before commencing launch (hours)
⑯	RDEC	Ratio of high-altitude range to low-altitude range (RANGEDEC); for missiles, flight time variable
⑰	ICLS	Target class number (ICLASS) for weapons: 1=missile; 2=bomber
⑱	RANGEREF	Refueled range for bombers; minimum range (n. miles)
⑲	REL	Reliability of weapon vehicle
⑳	CC	Command and control reliability for weapon vehicle
㉑	TOTAL WEAPONS	Sum of Column ②

Figure 19. Basic Weapon Group Information Print (Print Option 1) (Part 1 of 2)

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SALVOED WEAPON STOCKPILE (AFTER REMOVAL OF FIXED WEAPONS)

GROUP (1)	SALVO (2) 1 (3)	2	3	4	5 24
1	5	5	5	5	5 5
2	2	2	2	0	0 0
3	3	0	1	3	1 0
4	0	0	0	1	5 0

HEADING	LABEL	DESCRIPTION
(1)	GROUP	Group number
(2)	SALVO	Salvo number
(3)	--	Number of weapons in salvo for this group

Figure 19. (Part 2 of 2)

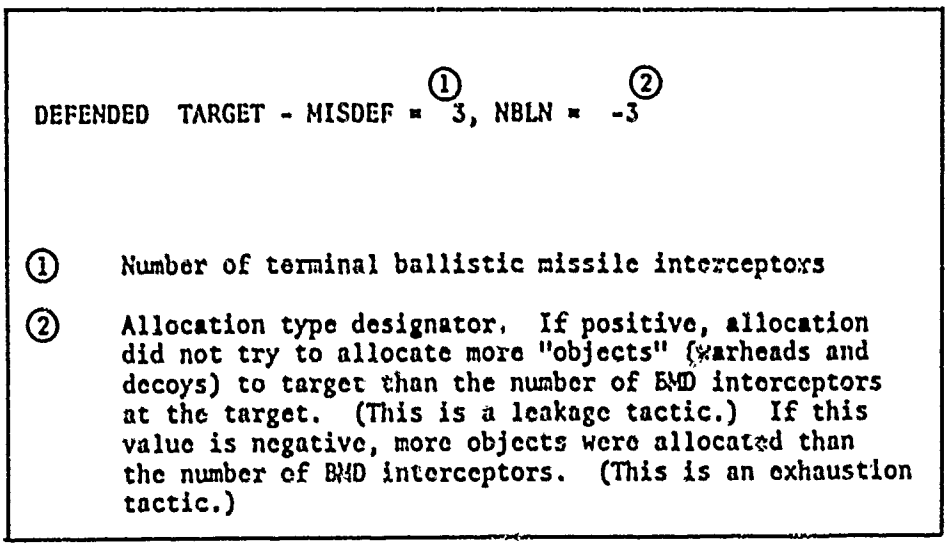

Figure 20. Defended Target Summary Print
(Print Option 16)

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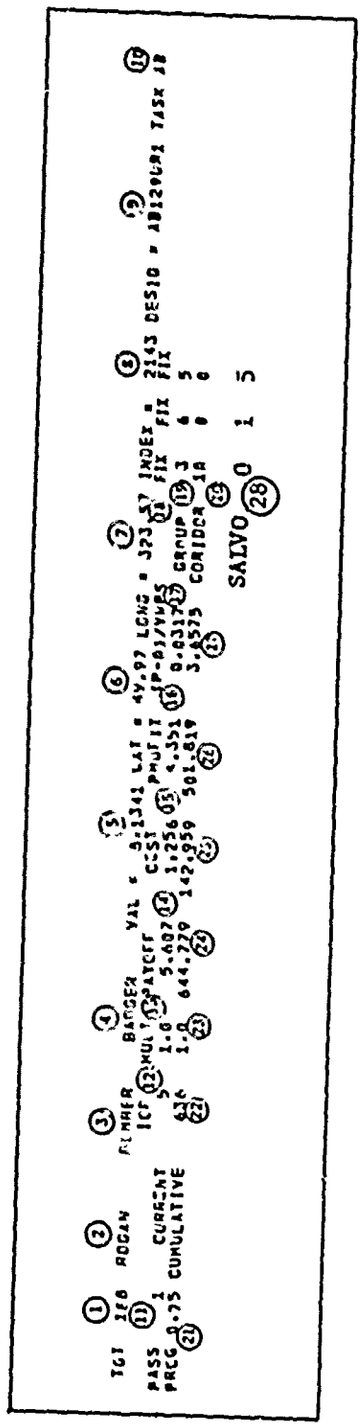

Figure 21. Weapon Allocation Print
(Print Option 2)
(Part 1 of 2)

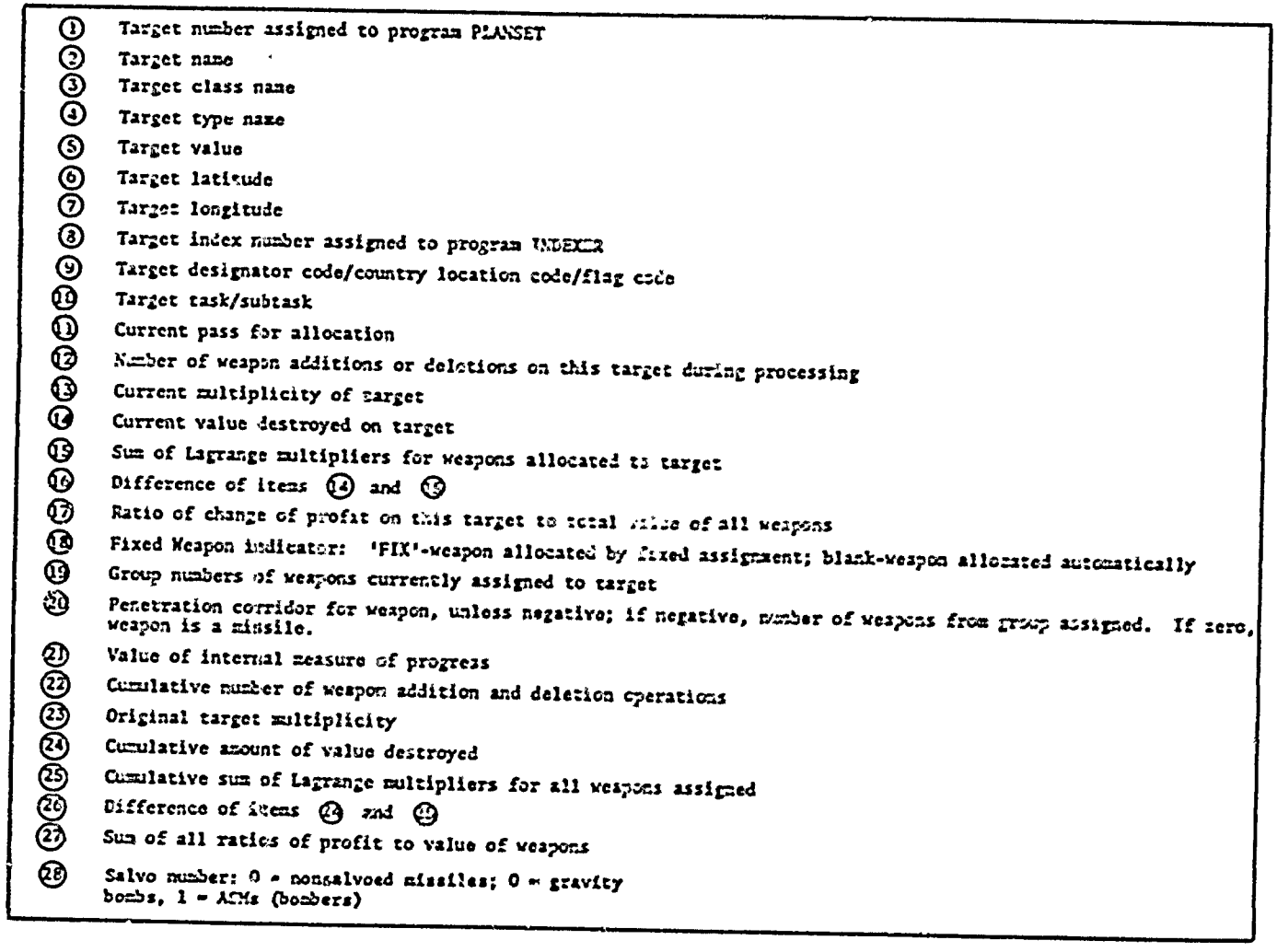

Figure 21. (Part 2 of 2)

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The quantity SDELTEFF therefore provides an estimate of how efficient the allocation would have been if the allocation had been terminated one pass earlier. Presumably, the current efficiency is substantially higher, but SDELTEFF does not, at this point, give any indication of how much. It is nevertheless of value in developing experience on how soon the PROGRESS .75 phase can be terminated. When PROGRESS is equal to 1.00 the multipliers are frozen, and this role of SDELTEFF ceases to be relevant. The quantity is then reset to zero. Thereafter it provides a measure of the effect on the profit of closing to the exact stockpile. Usually during the closing phase SDELTEFF goes slightly negative. However, since during this phase we continue to replace allocations originally produced with slightly different values of the multipliers, the value may go positive for a while until the closing forces get large enough to force closure even at some loss of profit. Thus the value of SDELTEFF at the end of the PROGRESS = 1.0 phase measures the loss of profit associated with closing. In the event that closing requires more than one full pass a test has been inserted which causes SDELTEFF to continue to accumulate over more than one pass when PROGRESS = 1.0.

Finally, when PROGRESS = 2.0 the quantity is again set equal to zero. If a verification pass is carried out, SDELTEFF then measures any increase in profit in the verification pass relative to the final allocation. In this role it defines an upper limit on the inefficiency of the actual allocation.

3.3.1.2.2 Summary Weapon Allocation Data. This print (print option 4) displays a summary of the weapon allocation. It always appears at the end of the weapon allocation process. If a verification pass is made, this print appears at the end of that pass. Figure 22 displays this print.

3.3.1.2.3 Timing Information for ALLOCATE Function. This print (option 23) displays the amount of time spent in processing the various phases of weapon allocation.

3.3.1.2.4 Termination of ALLOCATE Function. The ALLOCATE function will terminate normally on one of three conditions:

a. More than 1.5 passes while PROGRESS = 1.0

b. $|VALERR| < VALWPNS * ERRCLOS$, where VALERR is the absolute value of the sum of the Lagrange multipliers for all under- or over-allocated weapons, VALWPNS is the sum of the Lagrange multipliers for all weapons in the stockpile, and ERRCLOS is a user-input parameter for the ALLOCATE function.

c. $SUMSQERR < 1/(10*NTGTS^2)$ where NTGTS equals the number of targets and SUMSQERR equals the sum of the squares of the allocation error estimates.

①	② LAMBDA	③ XALL	④ RNALL	⑤ RNALL/NWPNS	VALWPNS=	⑥ 219.0084	VALERR=	⑦ 76.8694
1	0.571938	18	18	0.250				
2	0.272487	0	0	0.000				
3	0.571144	18	18	0.250				
4	0.272487	0	0	0.000				
5	0.421496	6	6	0.120				
6	0.422408	6	6	0.120				
7	0.618269	5	5	0.100				

HEADING	LABEL	DESCRIPTION
①		Weapon group index
②	LAMBDA	Value of Lagrange multiplier for group
③	XALL	Number of weapons of each weapon group that have been allocated since the start of the current pass
④	RNALL	Number of weapons of each weapon group that are currently allocated; considers all passes
⑤	RNALL/NWPNS	Ratio of the weapons allocated from each weapon group to the total number of weapons assigned to the group
⑥	VALWPNS	Current value of all weapons
⑦	VALERR	Current value of the error in the allocation process

Figure 22. Weapon Allocation Summary Print
(Print Option 4)

d. If convergence is unlikely, i.e., PROGRESS ≈ 0.75 is not achieved by the end of PASS 3, the run will be terminated (see Error Messages, ALLOCATE Function, message 13).

When condition 1-3 occurs, the message "FINAL WEAPON ALLOCATION"* is printed followed by a print of options 2, 4, and 23. If the input parameter IVERIFY is nonzero, a verification pass is then made. At the end of the verification pass, or immediately following prints described above, the message "END OF WEAPON-TARGET PROCESSING" is printed, followed by a print of options 2, 4, and 23.

3.3.1.3 Detailed Prints. These prints are described according to their print option as follows.

a. Print Option 1 (Basic Weapon Group Information). This print is a standard print described in figure 19.

b. Print Option 2 (Weapon Allocation). This print is a standard print described in figure 21.

c. Print Option 4 (Weapon Allocation Summary). This print is a standard print described in figure 22.

d. Print Option 5 (Target Weight Information). This is a print of data on target weights and rates of change of weights. Figure 23 displays this print.

e. Print Option 6 (Basic Target Data). This print displays the basic target data prior to the allocation of weapons to the target. Figure 24 displays this print.

f. Print Option 7 (Weapon/Target Interaction Data). This print displays the basic weapon/target interaction data before weapon allocation. Figure 25 displays this print.

g. Print Options 8, 9, 10. These prints are debug prints described in the next section.

h. Print Option 11 (Initial Values of Lagrange Multipliers). This print, available only at the start of the ALLOCATE function, prints the initial values of the local Lagrange multipliers. Figure 26 displays this print.

i. Print Options 12 and 13. These prints are debug prints described in the next section.

j. Print Option 16 (Defended Target Summary). This print is a standard print described in figure 20.

* For condition 4, the referenced error message is printed.

PRINT NO. 5

	① 1	② 2	③ 3
WTFAC ④	7,28011+000	7,28011+000	7,28011+000
WTRATE ⑤	1,00000+000	1,00000+000	1,00000+000
WTSUM ⑥	2,00786+002	2,00786+002	2,01287+002

HEADING	LABEL	DESCRIPTION
①	1	Column for first (shortest) integration period
②	2	Column for second integration period
③	3	Column for third (longest) integration period
④	WTFAC	Current running target weight in each integration period
⑤	WTRATE	Rate of increase of target weights in each integration period
⑥	WTSUM	Sum of target weights in each integration period

Figure 23. Print Option 5 - Target Weight Information

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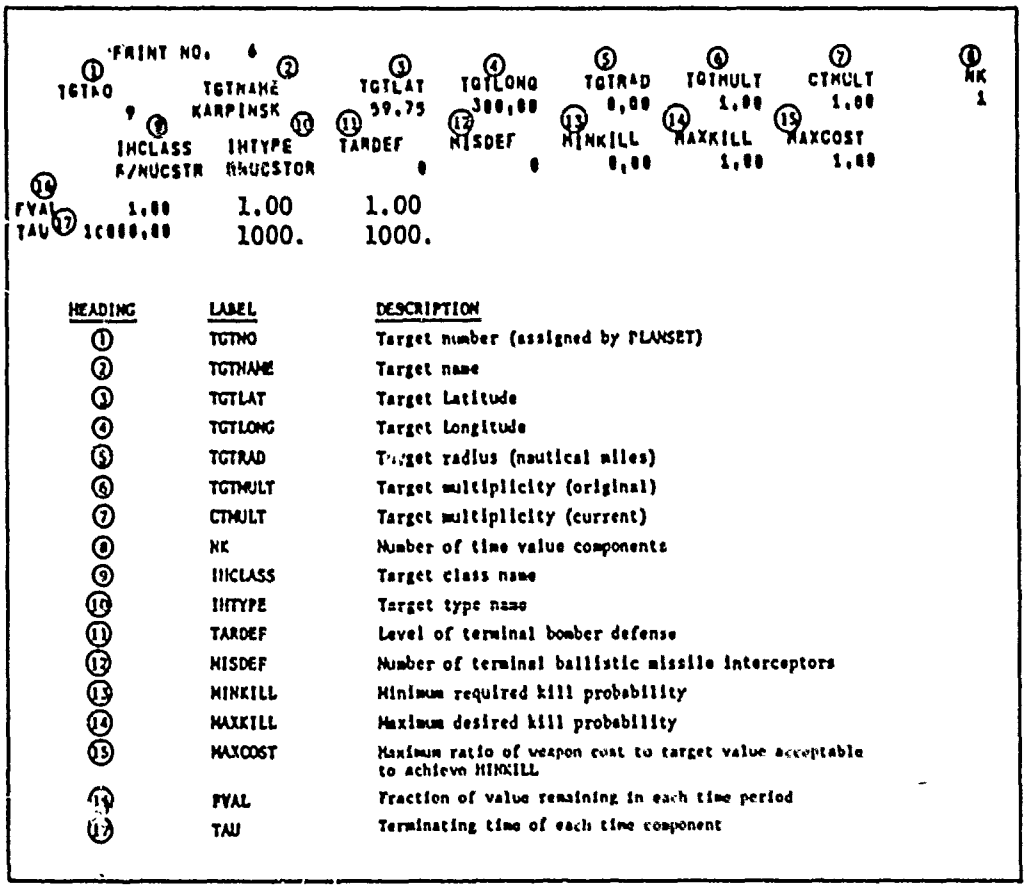

HEADING	LABEL	DESCRIPTION
①	TGTNO	Target number (assigned by PLANSET)
②	TGTNAME	Target name
③	TGTLAT	Target Latitude
④	TGTLONG	Target Longitude
⑤	TGTRAD	Target radius (nautical miles)
⑥	TGTMULT	Target multiplicity (original)
⑦	CTMULT	Target multiplicity (current)
⑧	NK	Number of time value components
⑨	IHCLASS	Target class name
⑩	IHTYPE	Target type name
⑪	TARDEF	Level of terminal bomber defense
⑫	MISDEF	Number of terminal ballistic missile interceptors
⑬	MINKILL	Minimum required kill probability
⑭	MAXKILL	Maximum desired kill probability
⑮	MAXCOST	Maximum ratio of weapon cost to target value acceptable to achieve MINKILL
⑯	FVAL	Fraction of value remaining in each time period
⑰	TAU	Terminating time of each time component

Figure 24. Print Option 6--Basic Target Data

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PRINT NO. 7

ITGT ①	VTO ②	M ③
3	11.65	1

	VO ④	M ⑤
VO ④	11.65	0.00
M ⑤	1.71	0.00
⑬ HA	1.03	0.03
⑯ DMOM 0		

⑥	TOA ⑦	TVALTOA ⑧	VTOA(1) ⑨	HUP(1) ⑩	SSIU(1) ⑪	VTOA(2) ⑫	HUP(2) ⑬	SSIG(2) ⑭
1	0.20	7.28	7.28	0.56	0.66			
2	0.20	7.28	7.28	0.56	0.66			
3	0.20	7.28	7.28	0.56	0.66			
4	0.23	7.28	7.28	0.56	0.66			
5	0.22	7.28	7.28	0.56	0.66			
6	0.21	7.28	7.28	0.56	0.66			
7	0.59	2.65	2.65	0.32	0.25			
8	0.56	2.65	2.65	0.32	0.25			
9	0.43	7.28	7.28	0.56	0.67			
10	0.36	7.28	7.28	0.56	0.67			
11	3.21	7.28	7.28	1.10	2.75			
12	9.21	0.00	0.00	0.14	0.07			
13	3.21	7.28	7.28	1.07	2.54			
14	9.21	0.00	0.00	0.15	0.07			
15	3.21	7.28	7.28	1.19	3.29			
16	3.05	7.28	7.28	1.17	3.18			
17	9.05	0.00	0.00	0.14	0.08			

HEADING	LABEL	DESCRIPTION
①	ITGT	Target number (assigned by program PLANSET)
②	VTO	Original target value
③	M	Number of hardness components
④	VO	Value in each hardness component
⑤	H	Lethal radius in nautical miles of each hardness component for a 1 megaton ground burst
⑥		Group number
⑦	TOA	Time of weapon arrival (hours)
⑧	TVALTOA	Value at risk in this time of arrival period
⑨	VTOA(1)	Value of first hardness component at time of arrival
⑩	HUP(1)	Kill factor for first hardness component
⑪	SSIG(1)	Differential kill factor for first hardness component
⑫ - ⑭		Same as ⑨ - ⑪ for second hardness component (blank if one component
⑬	HA	Lethal radius in nautical miles of each hardness component for a one megaton air burst
⑯	DMOM	Desired height of burst (0 = ground; 1 = air)

Figure 25. Print Option 7--Weapon/Target Interaction Data

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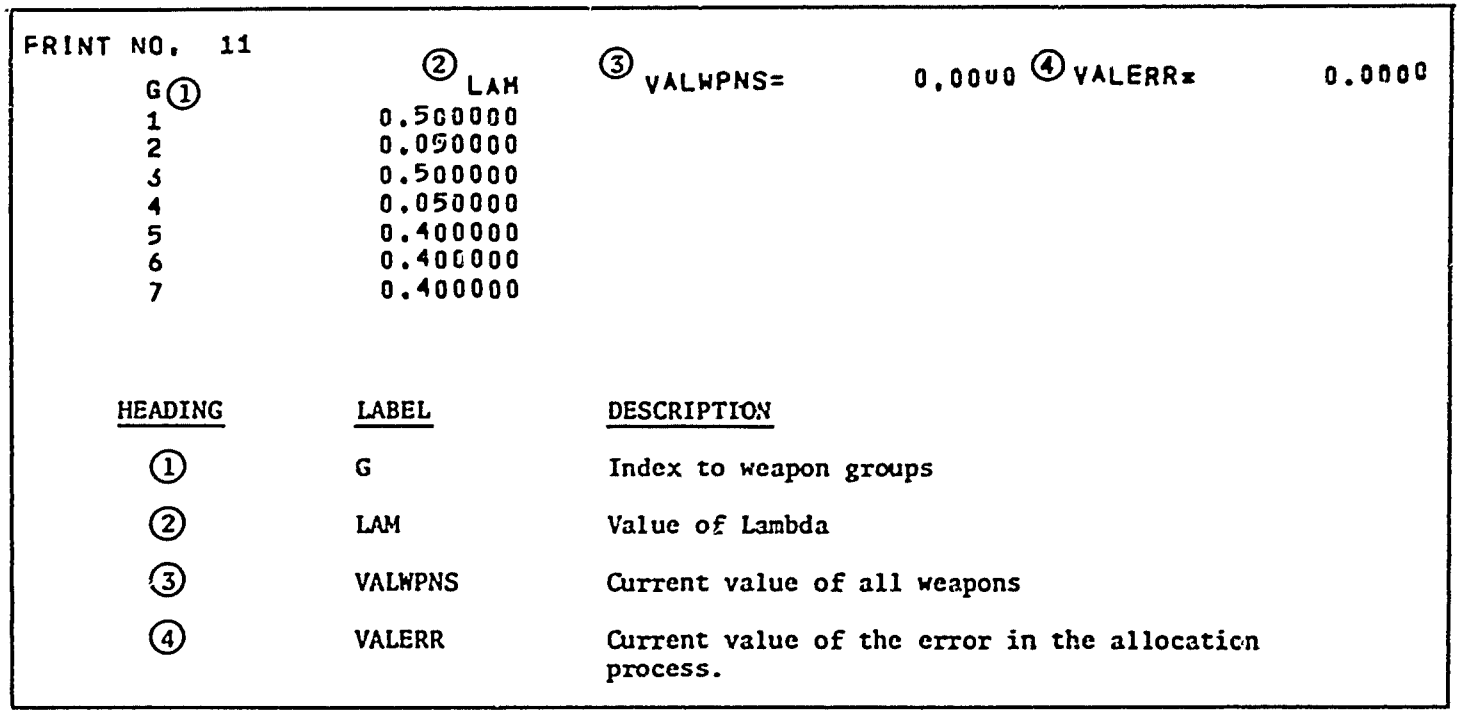
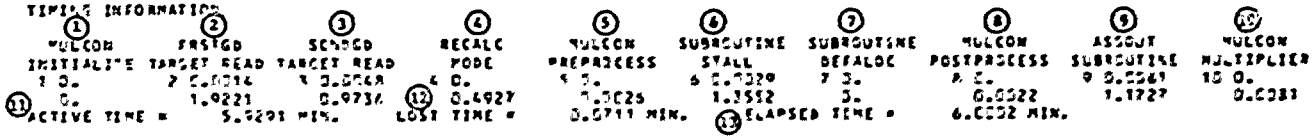
```
FRINT NO.  11
                    ②                ③                                  ④
      G ①          LAM        VALWPNS=        0.0000  VALERR=        0.0000
      1          0.500000
      2          0.050000
      3          0.500000
      4          0.050000
      5          0.400000
      6          0.400000
      7          0.400000
```



HEADING	LABEL	DESCRIPTION
①	G	Index to weapon groups
②	LAM	Value of Lambda
③	VALWPNS	Current value of all weapons
④	VALERR	Current value of the error in the allocation process.

Figure 26. Print Option 11--Initial Values of Lagrange Multipliers



READING	LABEL	DESCRIPTION
1	MULCON INITIALIZE	Time spent in initializing variable in subroutine MULCON
2	FRSTGD TARGET READ	Time spent reading in target data on pass one
3	SCNDGD TARGET READ	Time spent reading in target data on passes two and beyond
4	RECALC MODE	Time spent during pass one calculating weapon/target data
5	MULCON PREPROCESS	Time spent in MULCON prior to calls to STALL and DEFALOC
6	SUBROUTINE STALL	Time spent in subroutine STALL
7	SUBROUTINE DEFALOC	Time spent in subroutine DEFALOC
8	MULCON POSTPROCESS	Time spent in MULCON to update weights sums and profits
9	ASSOUT SUBROUTINE	Time spent updating assignment records
10	MULCON MULTIPLIER	Time spent in MULCON adjusting Lagrange multipliers
11	ACTIVE TIME	Sum of second row of time for items 1 - 13
12	LOST TIME	Time spent in print routines
13	ELAPSED TIME	Sum of 11 and 12

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Figure 27. Print Option 23 --Timing Information

k. Print Options 19, 20, 21, and 22. These prints are debug prints described in the next section.

l. Print Option 23 (Timing Information). This print displays timing data on the processing during the ALLOCATE function. Figure 27 displays this print. All times are shown in units of minutes. In each column there are two rows of times. The top row is the amount of time recorded in the last call to the timing subroutine for this purpose. The second row is the sum of the times recorded.

m. Print Option 24. This print is a debug print described in the next section.

n. Print Option 25 (Inactive Array). This print displays the value of the inactive flags during processing. These flags determine which weapons may be allocated to each target. The code for the inactive flags is:

- 100	Currently on target.
0	Active. May be allocated to target.
+ 100	Inactive. May not be allocated to target.
2000	Conditionally active. May be allocated to meet MINKILL.
30000	Conditionally active. May be allocated to meet MINKILL.

Codes 2000 and 30000 are similar but arise at different stages of processing in subroutine WAD. Figure 28 displays the format of this print.

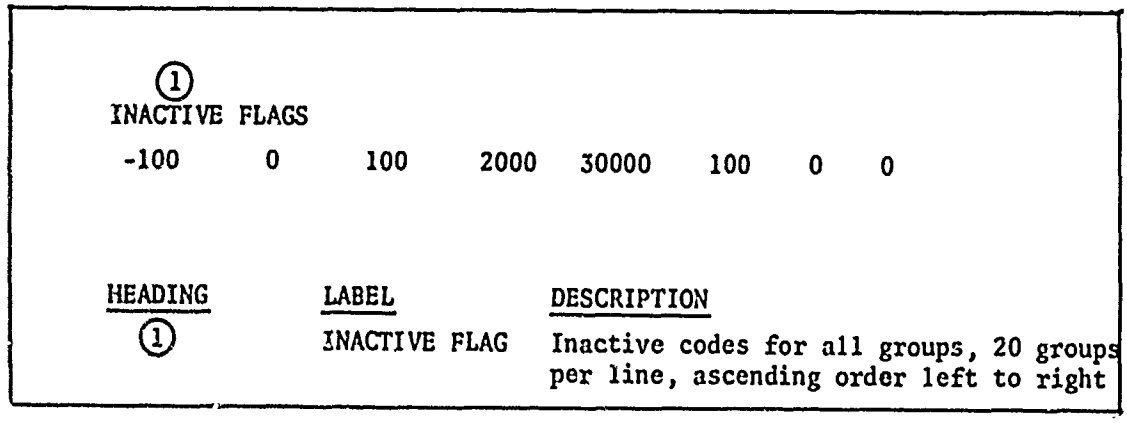

Figure 28. Print Option 25--Inactive Array

o Print Option 26 (Bomber Penetration Probability). This print displays the results of the penetration probability calculations performed by subroutine GETDTA in the first pass.

p. Print Options 27, 28, 29 and 30. These prints are debug prints described in the next section.

3.3.1.4 Debug Prints. These print options are used to investigate problems which may arise in allocating weapons. Because of the nature of these prints, the description of the variables printed is somewhat incomplete unless the user becomes familiar with the details of program ALOC. The last print described in this section is obtained if the value of the user input parameter IMATCH is set to 100.

a. Print Option 8 (Risk Array). This print displays the RISK array before the allocation begins on each target. This array contains the estimates of the cross correlation factors affecting weapon effectiveness. Figure 30 displays the format of this print.

b. Print Option 9 (Marginal Value for Currently Allocated Weapons). This print summarizes the weapons assigned to the present target and the marginal values for each. (See print option 22 for companion print for potential weapons.) Figure 31 displays the format of this print.

c. Print Option 10 (Weapon Profit and Efficiency Information). This print displays the variables transmitted from subroutine WAD to subroutine STALL. Figure 32 displays the format of this print.

d. Print Option 12 (Weapon-Target Calculation Synopsis). This print gives a synopsis of the actual weapon-target calculations performed in subroutine WAD. Figure 34 displays this print.

e. Print Option 13 (Payoff Calculations). This print displays the results of the calculations for payoff for weapon addition and deletion. Figure 34 displays the format of this print.

f. Print Option 19 (Planning Factors for Terminal BMD Targets). This print summarizes the planning factors for targets with terminal ballistic missile defenses (BMD). Figure 35 displays the format of this print.

g. Print Option 20 (WADOUT Summary). This print summarizes the variables output by subroutine WADOUT. Figure 36 displays this print.

h. Print Option 21 (Allocation Error Estimates). This print lists all the allocation error estimates (ALLEREST). Figure 37 displays this print.

TARGET 21 ①

GROUP ②	KORR ③	PENETRATION PROBABILITIES BY CORRIDOR ④											
1	7	0.000	0.000	0.742	0.000	0.000	0.000	0.869	0.000	0.000	0.000	0.678	0.596
2	7	0.000	0.000	0.742	0.000	0.000	0.000	0.869	0.000	0.000	0.000	0.678	0.596
3	7	0.000	0.000	0.733	0.000	0.000	0.000	0.869	0.000	0.000	0.000	0.639	0.561
4	7	0.000	0.000	0.733	0.000	0.000	0.000	0.869	0.000	0.000	0.000	0.639	0.561

HEADING	LABEL	DESCRIPTION
①	TARGET	Target number assigned by program PLANSET
②	GROUP	Group number
③	KORR	Number of preferred penetration corridor for this group on this target
④	PENETRATION PROBABILITIES BY CORRIDOR	Penetration probability for this group to this target through each corridor in ascending order left to right

Figure 29. Print Option 26--Bomber Penetration Probability

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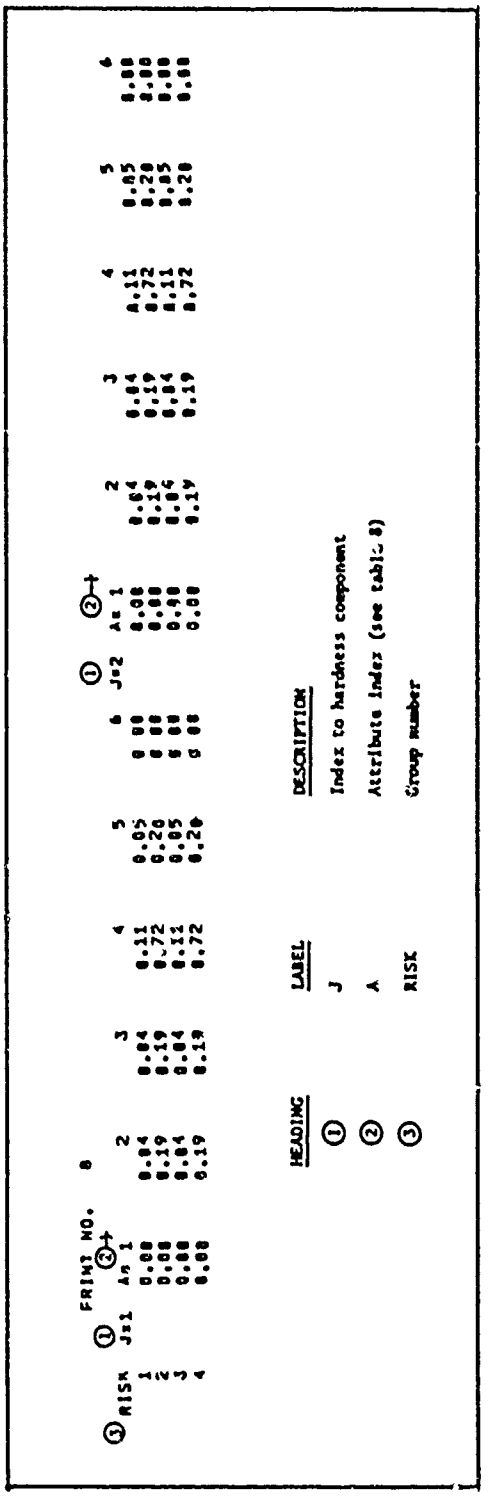
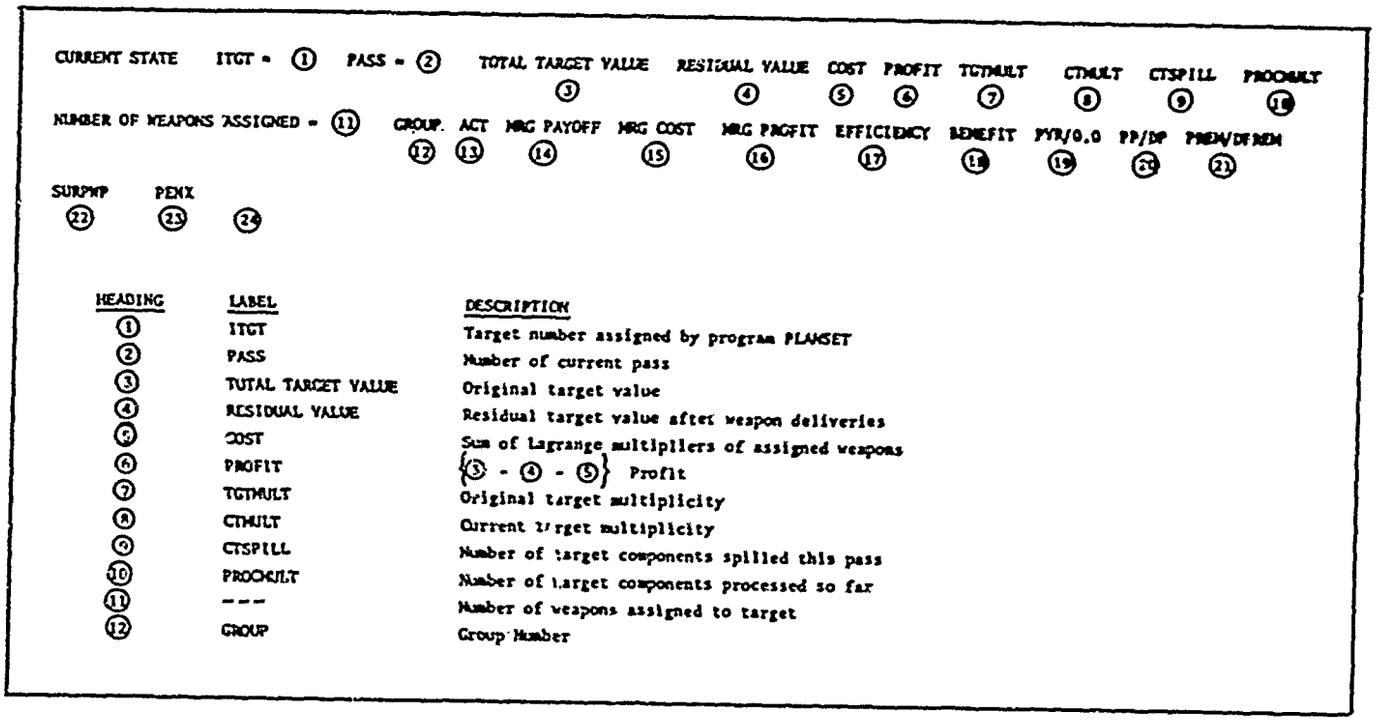


Figure 30. Print Option 8- - RISK Array Print



HEADING	LABEL	DESCRIPTION
①	ITGT	Target number assigned by program PLANSET
②	PASS	Number of current pass
③	TOTAL TARGET VALUE	Original target value
④	RESIDUAL VALUE	Residual target value after weapon deliveries
⑤	COST	Sum of Lagrange multipliers of assigned weapons
⑥	PROFIT	{③ - ④ - ⑤} Profit
⑦	TGTMULT	Original target multiplicity
⑧	CTMULT	Current target multiplicity
⑨	CTSPILL	Number of target components spilled this pass
⑩	PROCMULT	Number of target components processed so far
⑪	---	Number of weapons assigned to target
⑫	GROUP	Group Number

Figure 31. Print Option 9--Marginal Value for Currently Allocated Weapons (Part 1 of 2)

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(13)	ACT	Value of inactive flag
(14)	MRG PAYOFF	Marginal payoff for this weapon
(15)	MRG COST	Value of Lagrange multiplier for this weapon
(16)	MRG PROFIT	Marginal profit {(14) - (15)}
(17)	EFFICIENCY	Weapon efficiency {(16) / (15)}
(18)	BENEFIT	Profit including premium and damage constraints
(19)	PVR/0.0	= 0.0 (dummy variable)
(20)	PP/DP	Modified profit ((18) - (15))
(21)	PREM/DPREM	Premium for removing weapon
(22)	SURPWP	Estimated error in number of weapons used
(23)	PENX	Penetration probability
(24)	---	Preferred penetration corridor

Figure 31. (Part 2 of 2)

PROFIT = ① COST = ② TPMX = ③ ALPHA = ④ MINKILL = ⑤ MAXKILL = ⑥

MAXCOST = ⑦ PVRMX = ⑧ (⑨) PPMX = ⑩ (⑪) DPMN = ⑫ (⑬)

HEADING	LABEL	DESCRIPTION
①	PROFIT	Total profit on target
②	COST	Sum of Lagrange multipliers of weapons allocated this target
③	TPMX	Maximum profit considering damage constraints
④	ALPHA	Cost factor for damage constraints
⑤	MINKILL	Minimum desired kill probability
⑥	MAXKILL	Maximum desired kill probability
⑦	MAXCOST	Maximum value of weapon used to achieve MINKILL
⑧	PVRMX	Maximum value of modified efficiency, PVR
⑨	---	Group number which results in PVRMX, (IPVRMX)
⑩	PPMX	Maximum profit value for adding weapon
⑪	---	Group number which results in PPMX, (IPPMX)
⑫	DPMN	Maximum profit gained for deleting weapon
⑬	---	Group number which results in DPMN, (IDPMN)

Figure 32. Print Option 10--Weapon Profit and Efficiency Information

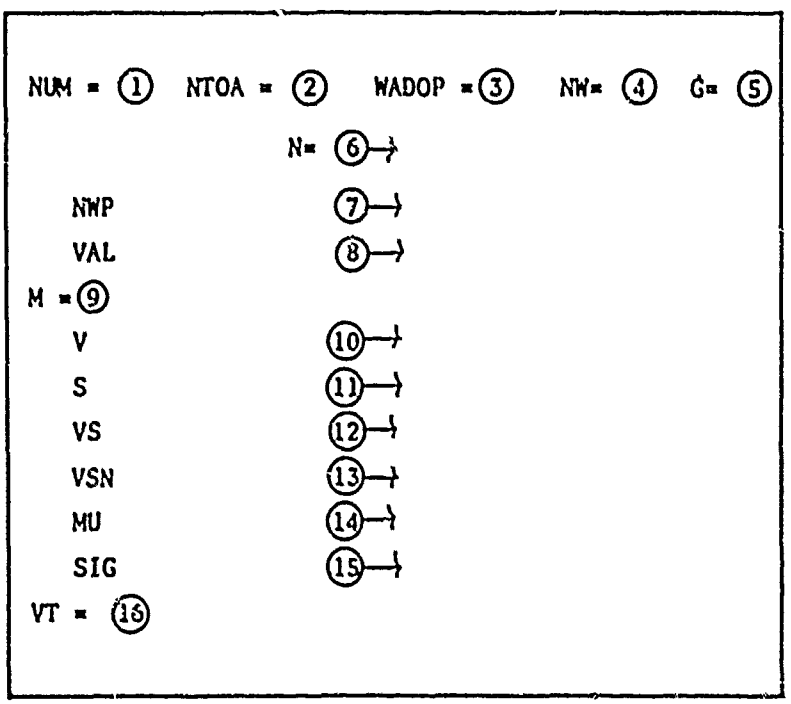
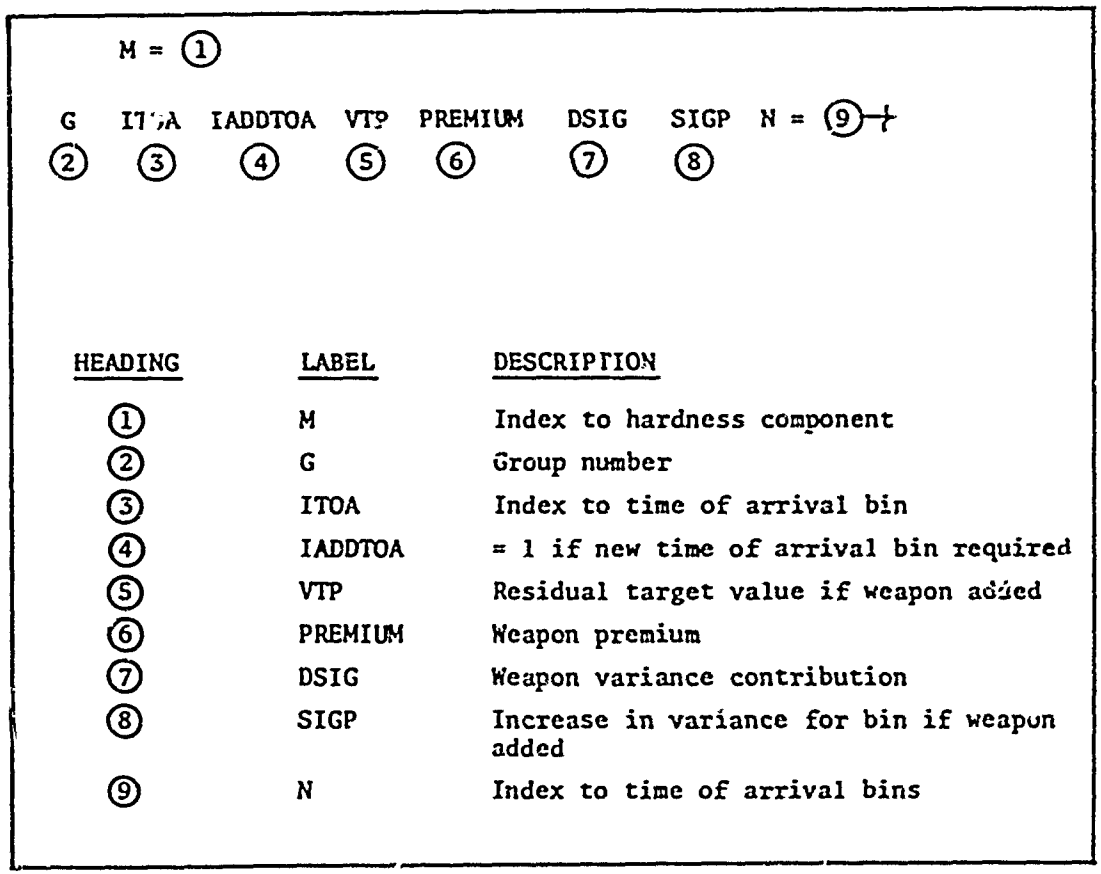


Figure 33. Print Option 12--Weapon Target Calculation Synopsis (Part 1 of 2)

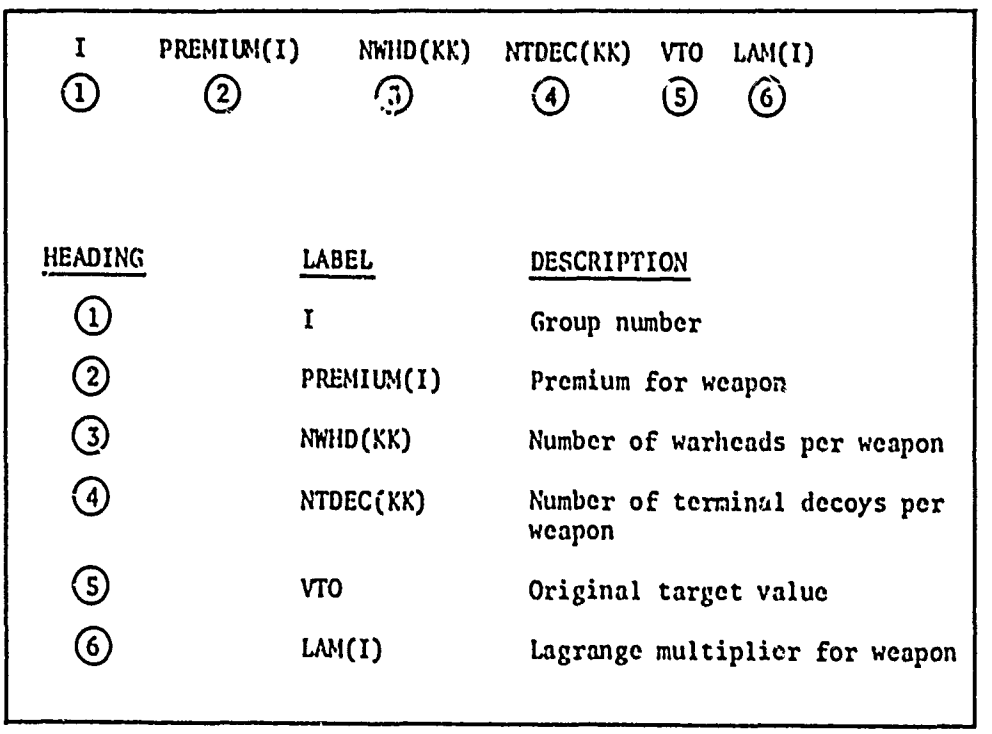
HEADING	LABEL	DESCRIPTION
(1)	NUM	Number of weapons currently allocated to target
(2)	NTOA	Number of time of arrival bins
(3)	WADOP	Operation code for subroutine WAD
(4)	NW	Group number to be deleted
(5)	G	Group number to be added
(6)	N	Index to time of arrival bin
(7)	NWP	Number of weapons in each bin
(8)	VAL	Value at risk in each bin
(9)	M	Index to hardness component
(10)	V	Value at risk in this component in this bin
(11)	S	Survival probability in this component in this bin
(12)	VS	Product of (10) and (11)
(13)	VSN	Normalized (12)
(14)	MU	Modified sum of mean kill factors
(15)	SIG	Modified sum of kill factor variances
(16)	VT	Residual target value

Figure 33. (Part 2 of 2)



HEADING	LABEL	DESCRIPTION
①	M	Index to hardness component
②	G	Group number
③	ITOA	Index to time of arrival bin
④	IADDTOA	= 1 if new time of arrival bin required
⑤	VTP	Residual target value if weapon added
⑥	PREMIUM	Weapon premium
⑦	DSIG	Weapon variance contribution
⑧	SIGP	Increase in variance for bin if weapon added
⑨	N	Index to time of arrival bins

Figure 34. Print Option 13--Payoff Calculations



HEADING	LABEL	DESCRIPTION
1	I	Group number
2	PREMIUM(I)	Premium for weapon
3	NWHD(KK)	Number of warheads per weapon
4	NTDEC(KK)	Number of terminal decoys per weapon
5	VTO	Original target value
6	LAM(I)	Lagrange multiplier for weapon

Figure 35. Print Option 19--Planning Factors-Terminal BMD Targets

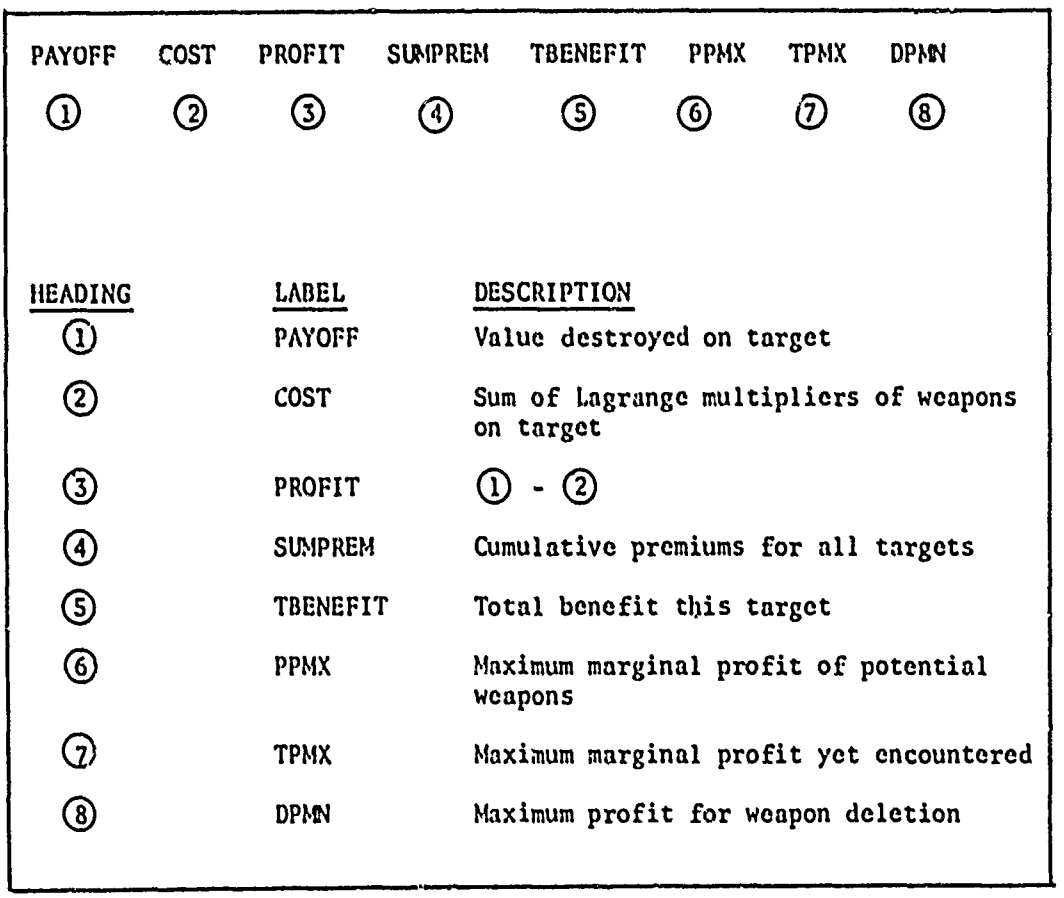


Figure 36. Print Option 20--WADOUT Summary

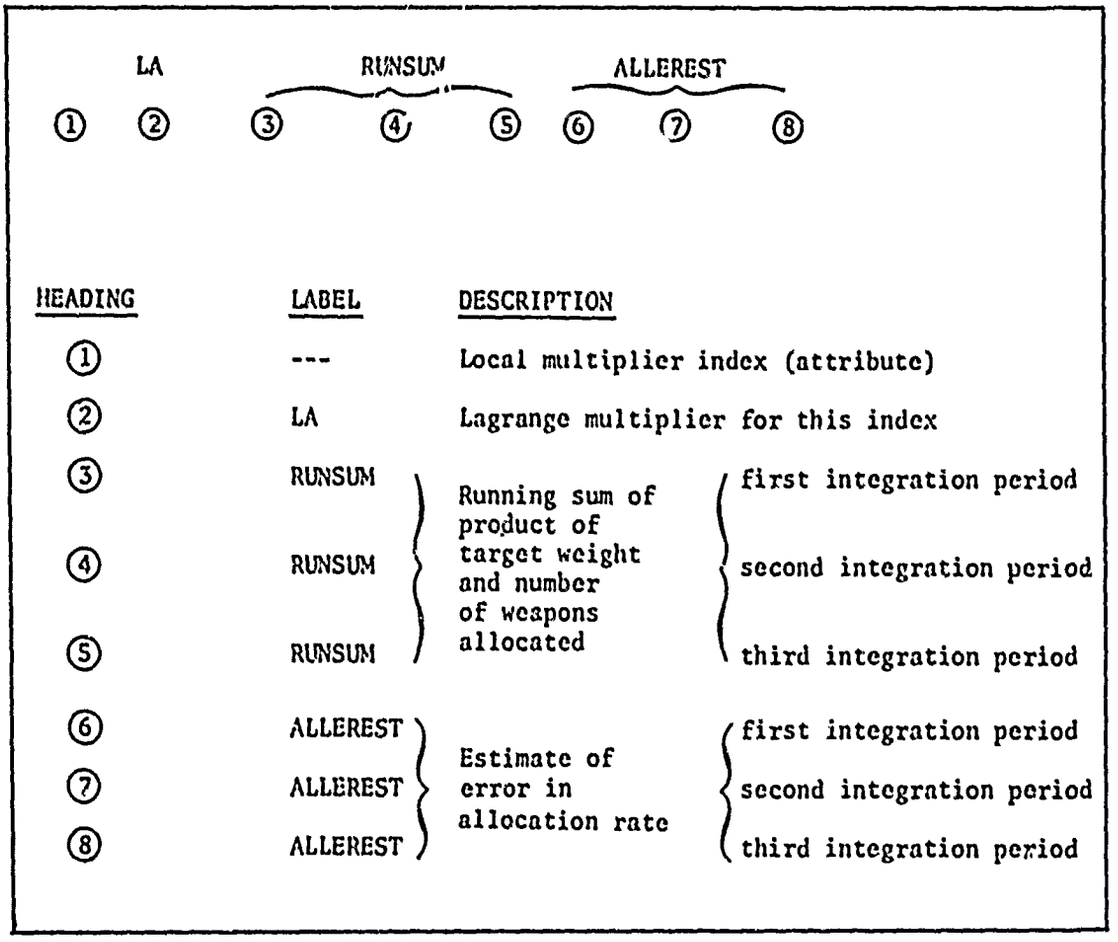


Figure 37. Print Option 21--Allocation Error Estimates

i. Print Option 22 (Marginal Value of Potential Weapons). This print summarizes the data on marginal payoffs for weapons which may be added to the target. The resulting decision by subroutine STALL is also printed. This print is a comparison to print option 9. Figure 38 displays print option 22; figure 39 shows STALL decision messages.

j. Print Option 24 (Termination Control). This print terminates the run with the message "REQUESTED DUMP." The run aborts and the operating system gives a memory dump.

k. Print Option 27 (Missile Rate of Return). This print displays the best rate of return achieved by any missile in the computations by subroutine DEFALOC. Figure 40 displays this print.

l. Print Option 28 (Terminal BMD Target Allocation). This print displays the allocation to a target with terminal ballistic missile defenses (BMD) and the resulting target residual value as computed by subroutine RESVAL. Figure 41 displays this print.

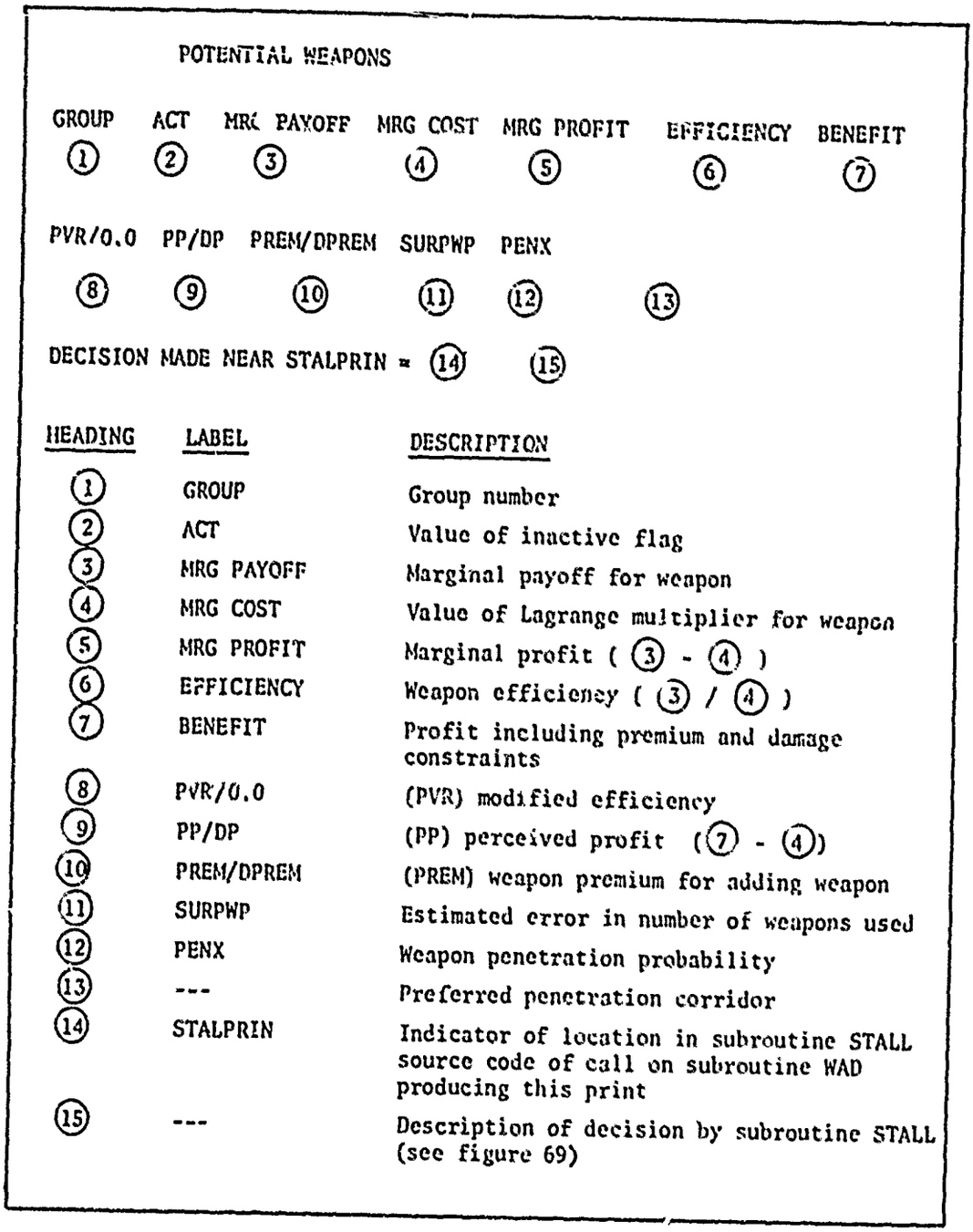
m. Print Option 29 (Salvoed Group Information). This print displays the Lagrange multiplier (for the first salvo), the balance parameter, and number of weapons overallocated from each salvo for missile groups with a launch interval. Exactly allocated salvoes have zero entries, underallocated salvoes have negative entries, and overallocated salvoes have positive entries (an entry of -3 means the salvo is underallocated by 3 weapons). Figure 42 displays this print.

n. Print Option 30 (Bomber Payload Indicators). This print displays the average value destroyed (excluding DBL and REL), the actual fraction of weapons that are ASMs, the payload indicator, and the currently allocated fraction of weapons that are ASMs for each bomber group. These factors are used in the selection of gravity bombs or ASMs on each target. Figure 43 displays this print.

IMATCH - Target Value Calculations for MINKILL/MAXKILL

This print is produced on every target if the value of the user input parameter IMATCH is set equal to 100. Figure 44 displays this print.

3.3.2 Error Messages. The error messages for ALOC are shown in figure 45. If any of messages 1-9 appear, the run is terminated after the first overlay and only the input processing takes place.



HEADING	LABEL	DESCRIPTION
①	GROUP	Group number
②	ACT	Value of inactive flag
③	MRG PAYOFF	Marginal payoff for weapon
④	MRG COST	Value of Lagrange multiplier for weapon
⑤	MRG PROFIT	Marginal profit (③ - ④)
⑥	EFFICIENCY	Weapon efficiency (③ / ④)
⑦	BENEFIT	Profit including premium and damage constraints
⑧	PVR/0.0	(PVR) modified efficiency
⑨	PP/DP	(PP) perceived profit (⑦ - ④)
⑩	PREM/DPREM	(PREM) weapon premium for adding weapon
⑪	SURPWP	Estimated error in number of weapons used
⑫	PENX	Weapon penetration probability
⑬	---	Preferred penetration corridor
⑭	STALPRIN	Indicator of location in subroutine STALL source code of call on subroutine WAD producing this print
⑮	---	Description of decision by subroutine STALL (see figure 69)

Figure 38. Print Option 22--Marginal Value of Potential Weapons

1. ADD (1)

2. DELETE (2)

3. RECALL PRIOR ALLOCATION

4. TERMINATE STALL ALLOCATION

MESSAGE	DESCRIPTION
1.	Add weapon from group (1)
2.	Delete weapon from group (2)
3.	Restore previous allocation. Used only on verification pass when IVERIFY = 2
4.	Return with current allocation

Figure 39. Messages of Decision by Subroutine STALL

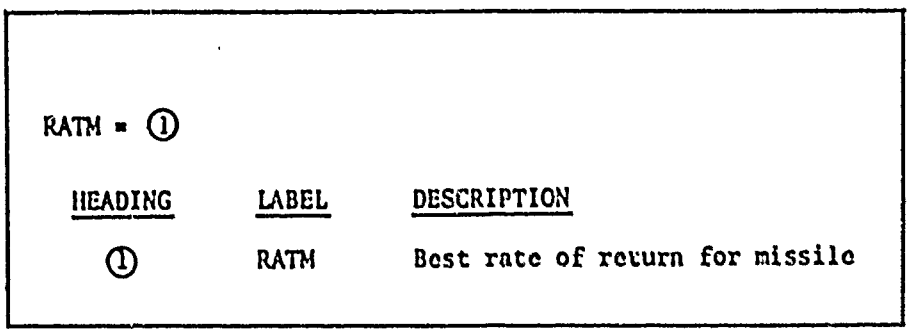


Figure 40. Print Option 27--Missile Rate of Return

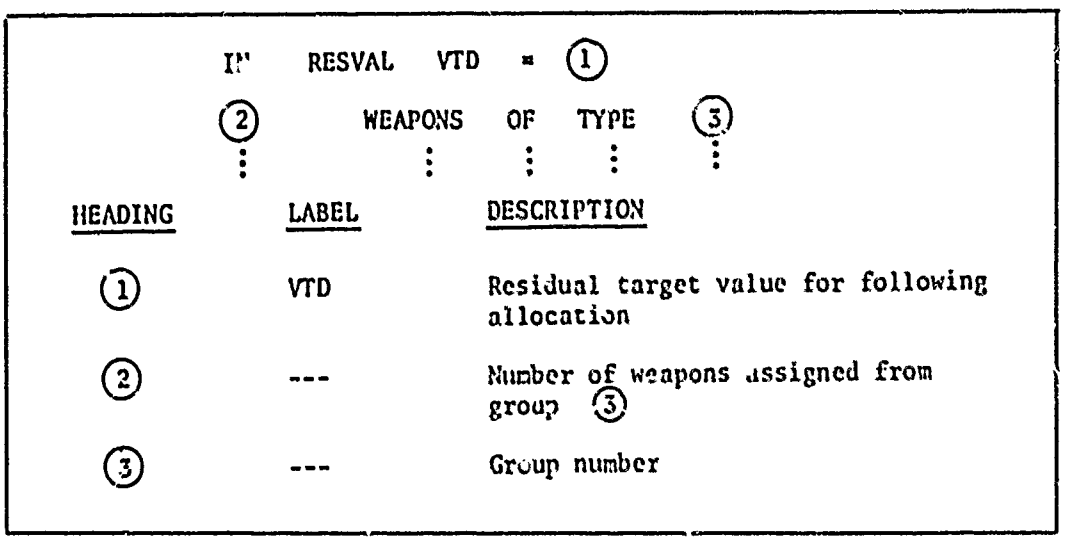
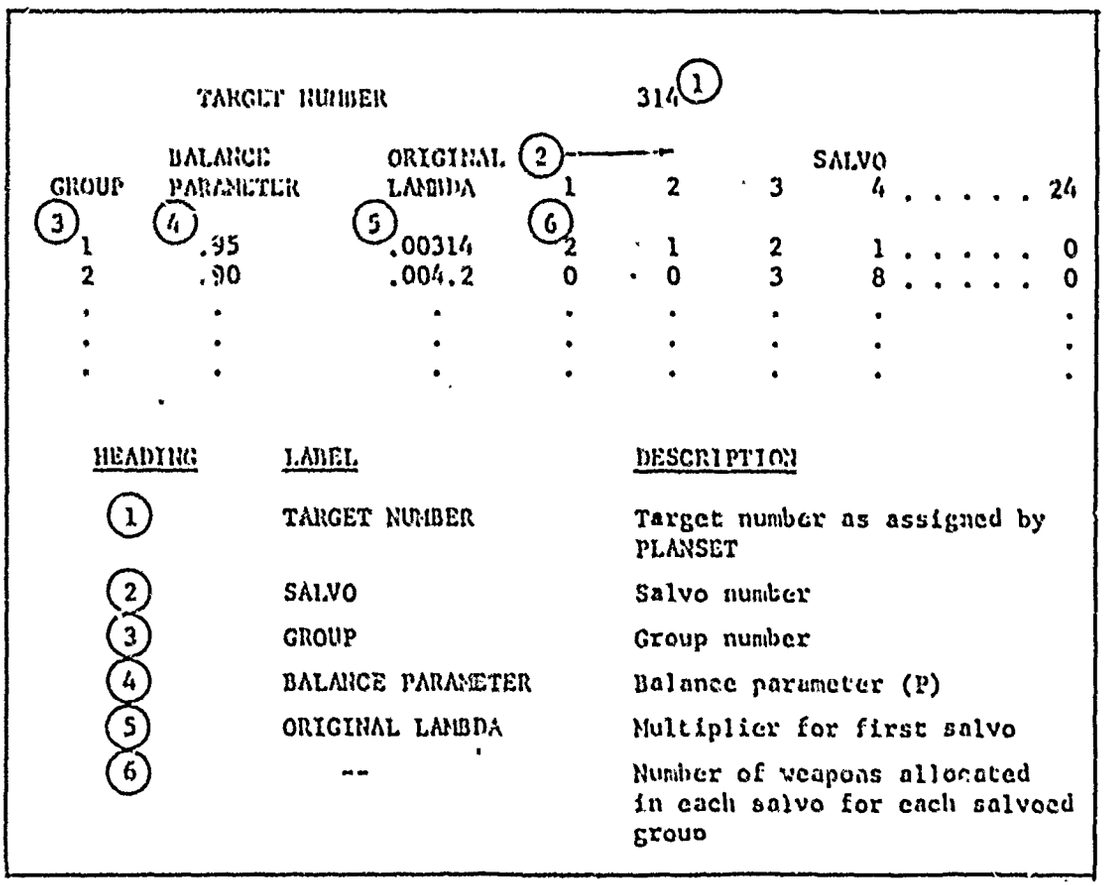


Figure 41. Print Option 28--Terminal BMD Target Allocation



TARGET NUMBER 314 (1)

GROUP (3)	BALANCE PARAMETER (4)	ORIGINAL LAMBDA (5)	SALVO (2) 1 (6)	2	3	4 24
1	.95	.00314	2	1	2	1 0
2	.90	.004.2	0	0	3	8 0
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.

HEADING	LABEL	DESCRIPTION
(1)	TARGET NUMBER	Target number as assigned by PLANSET
(2)	SALVO	Salvo number
(3)	GROUP	Group number
(4)	BALANCE PARAMETER	Balance parameter (P)
(5)	ORIGINAL LAMBDA	Multiplier for first salvo
(6)	--	Number of weapons allocated in each salvo for each salvoed group

Figure 42. Print Option 29-Salvoed Group Information

GROUP ①	AVDE ②	FASM ③	ISETPAY ④	EXPASM ⑤
2	0.232	0.010	1	0.500
3	0.591	0.110	0	0.100
⋮	⋮	⋮	⋮	⋮

HEADING	LABEL	DESCRIPTION
①	GROUP	Group number (Only bomber groups are printed)
②	AVDE	Absolute average difference in value destroyed between ASM and bomb
③	FASM	Fraction of currently allocated weapons in group which are ASMs
④	ISETPAY	Payload indicator for next target to be processed. Zero for gravity bomb use; one for ASM use
⑤	EXPASM	Actual fraction of weapons in the group which are ASMs

Figure 43. Print Option 30 - Bomber Payload Indicators

VTO ① VT ② VTZO ③ IFLGMN ④ IFLGMX ⑤ SVTMIN ⑥
SVTMAX ⑦ VTMIN ⑧ VTMAX ⑨ ALPHA ⑩

HEADING	LABEL	DESCRIPTION
①	VTO	Original target value
②	VT	Residual value
③	VTZO	Residual value ignoring time dependence
④	IFLGMN	Flag showing achievement of MAXKILL
⑤	IFLGMX	Flag showing achievement of MINKILL
⑥	SVTMIN	Minimum allowed residual target value ignoring time dependence of value
⑦	SVTMAX	Maximum allowed residual target value ignoring time dependence of value
⑧	VTMIN	Minimum allowed residual target value considering time dependence of value
⑨	VTMAX	Maximum allowed residual target value considering time dependence of value
⑩	ALPHA	Cost factor used to achieve MINKILL

Figure 44. IMATCH Print--Target Value Calculations for MINKILL/MAXKILL

1	ERROR IN INPUT FOR FLAGREST. Error in FLAGREST clause -- check order of parameters.
2	ERROR IN INPUT FOR LOCREST. Error in LOCREST clause -- check order of parameters and make sure all country location codes are valid.
3	ERROR IN MIRVREST CLAUSE. Check order of parameters and make sure all class names are valid.
4	ERROR IN READMUL INPUT. Error in READMUL clause -- check order of parameters, validity of flags. If old unit included check its validity.
5	ERROR IN ONFRINTS. Check order of parameters.
6	ERROR IN SETTING CLAUSE. Make sure all attributes are ALOC parameters.
7	ERROR IN SMAT CLAUSE. Check order and validity of parameters.
8	ERROR IN INPUT FOR MINRANGE. Error in MINRANGE clause -- check order of parameters.
9	ERROR IN INPUT FOR MODRANGE. Error in MODRANGE clause -- check order of parameters.
10	TARGET (1) HAS MORE THAN 30 WEAPONS FIXED The user has requested fixed assignment of more than 30 weapons on target number (1) . This target does not have terminal ballistic missile defenses and only the first 30 weapons are fixed to the target. The remaining requests for this target are ignored.

Figure 45. ALOC Module Error Messages (Part 1 of 3)

11 UNSATISFACTORY PROGRESS. RUN TERMINATED

After three full passes through the target list the value of PROGRESS is less than 0.75. The probability that the allocation process will converge to the correct stockpile at this point is very low. The job is therefore terminated. There are a large number of conditions which can cause this problem. A close check on the values of the target and planning factors should be made to see if the desired values are being used. If a run of this function with all default user input parameters does not remove this problem, consult a maintenance programmer.

12 FIXED ASSIGNMENT REQUEST NOT HONORED FOR GROUP (1) ON TARGET DESIG = (2) - INDEXNO = (3) - TARGET NO. = (4)
TARGET NO. = (4)
PROBLEM IS (5)

The user has requested a fixed assignment of a weapon from group (1) to a target with designator code (2) , index number (3) , and target number (4) . The request cannot be honored and the weapon is not allocated at all (to any target). The reason for not honoring the request is given in (5) . The reasons are as follows:

- o CNTRYL -- Restriction by country code (LOCREST option)
- o FLAG -- Restriction by flag code (FLAGREST option)
- o MINRAN -- Restriction by minimum range (MINRANGE option)
- o MIRV -- Restriction of MIRV weapons (MIRVREST option)
- o NAVAL -- Restriction of weapons with PKNAV = 0 to targets to class NAVAL and vice versa
- o PENETR -- Inadequate capability to penetrate to the target
- o RANGE -- Inadequate range to reach the target (possibly RANGEMOD option)
- o VALUE = 0 -- The target has zero value at the weapon time of arrival. (Data base entry or possibly VALUEMOD option of module PREPALOC.)

13 LOOP = (1)

In this message (1) is the total number of targets encountered so far on which more than 100 weapon addition or deletion operations (IOP) were required before subroutine STALL terminated the allocation process. Once this condition occurs, this message is printed as every succeeding target is processed. On each target with more than 100 weapon addition or deletion operations, the value of (1) is incremented by one. This message is for information only; no user action is required.

Figure 45. (Part 2 of 3)

14	TARGET (1) MINKILL REQUIRES TOO MANY WEAPONS On target with target number (1) , a target with terminal ballistic missile defenses, the required minimum target destruction probability cannot be achieved after an allocation of 40% of the total missile force that can reach this target. The program continues using the allocation of 40% of each missile group that can be allocated to this target. This message is for information only; no user action is required.
15	BOMBER FROM GROUP (1) CANNOT BE FIXED IN A MISSILE SATURATION ATTACK ON TARGET (2) - INDEX = (3) TARGET (4) The user has fixed a bomber weapon from group (1) on a target where he has fixed more than 30 weapons. The only case where an excess of 30 weapons is allowed is a missile saturation attack on a target with terminal ballistic missile defenses. The fix request for this bomber weapon is ignored and processing proceeds. The target name is displayed as (2) ; the index number as (3) ; the target number as (4) .

Figure 45. (Part 3 of 3)

SECTION 4. MODULE EVALALOC

4.1 General Purpose

The purpose of module EVALALOC is to summarize the planned allocation of weapons to targets and provide an expected-value estimate of the results. Provision is also included to evaluate the allocation for variations in values of selected parameters associated with the weapons and targets.

EVALALOC may be run at two stages of plan development, immediately after module ALOC or immediately after module PLANOUT. If run after ALOC the analysis of aim point offsets is not included in the allocation evaluation since the desired ground zeros (DGZs for complex targets) are not known at this stage of processing (these DGZs are established by module ALOCOUT). The evaluation of EVALALOC, therefore, is an upper limit estimate which assumes that each target element in a complex is directly targeted. When run after PLANOUT, however, weapon aim points offsets are included in the expected-value computations.

EVALALOC processes the targets one at a time. For each target (or target element of a complex target), the weapons assigned are collected and ordered by time of arrival. Surviving target values are calculated, utilizing the same damage functions used in module ALOC (subroutine WAD), except that correlations are ignored.

After the survival probability for each target is computed, the target and the allocated weapons are processed and categorized for processing purposes.

When all targets have been processed, the results are summarized and printed.

4.2 Inputs

The execution of module EVALALOC is initiated by the verb EVALUATE which may contain the following adverbs:

- o SETTING - Used to set probability of kill by terminal BMD and the type of damage law
- o ONPRINTS - Used to turn on detailed target prints
- o SORT - A stand alone clause. It's presence causes the detailed target prints to be sorted by area, country location, and DESIG
- o TGTMOD - Introduces a clause whereby target attributes may be altered and the allocation evaluated accordingly

- o WPNMOD - Introduces a clause whereby weapon attributes may be altered and the allocations evaluated accordingly
- o COUNTRIES - Evaluation of the allocation may be conducted only on those targets which reside within the country locations as introduced by this adverb

All adverbs for this module are optional; the verb by itself can be sufficient for a successful execution.

The general form of EVALALOC command is:

EVALUATE [SETTING {PKTY / LAW} = value . . .]

[ONPRINTS target-number] [SORT]

[TGTMOD {ALLTGT / target type} / parameter, value [(weapon-type . . .

, weapon type)] [/ parameter . . .]]

[WPNMOD {ALLWP / BOMBER / MISSILE / WEAPON-type / GROUP-group-number} / {CEP / REL / DBL / YIELD} , value

[/ attribute , . . .] [type indicator / . . .]]

[COUNTRIES {INCLUDE / EXCLUDE} value, value , . . . , value]

4.2.1 Mode of Execution. Normally, EVALALOC evaluates the allocation using all parameters as defined within the data base. However, to permit sensitivity analysis, the cited adverbs permit the altering of selected target or weapon attributes and performing the evaluation on the altered values. Any number combinations of defined adverbs may be executed within one command. Each combination constitutes a cycle over the entire target list for every set of adverbs. In effect, the module counts the occurrence of adverbs and when any adverb occurs a second time (or there are no more adverbs) the current adverbs are used. Then, beginning with the adverb that caused the execution, the counts begin again.

Consider a desire to execute EVALALOC for the default value of PKTX (=0.) and an analysis of results for a value of PKTX=.1. The command could be

EVALUATE SETTING PKTX=0. SETTING PKTX=.1

Two separate calculations will be conducted over the target assignment list. A second possible command could be:

EVALUATE EVALUATE SETTING PKTX=.1

Both commands produce identical results.

4.2.2 The SETTING Adverb. Used to set the probability of kill by terminal BMD (PKTX) or to set the damage law for area targets (LAW). PKTX assumes a range from zero to one and has a default value of zero. LAW can equal either POWER or SQUAROOT and has a default of POWER.

4.2.3 The ONPRINTS Adverb. This adverb causes detailed target related information to be printed. The number following this adverb defines the highest target number to be printed. If the adverb is not supplied, only the summarizing tables will be produced.

4.2.4 The SORT Adverb. Detailed target prints are supplied in target number order if the SORT adverb is absent. The inclusion of SORT causes the detailed print to be order by area, country location and DESIG. The SORT adverb is a stand alone clause.

4.2.5 The TGTMOD Adverb. This clause is used to alter target parameters: FVULN1 (hardness of first component); V0Z (original value of first hardness component); T(1) (first time component of the target); FVALT1 (fraction of value in first time component); PEN (probability that weapon will penetrate to target). The form of the phrase or phrases is the target-type (or ALLTGT meaning all target types) specified by a series of phrases each preceded by a slash. Each phrase is the target

parameter to be changed followed by a comma and the new value of the target parameter. The target parameter will be altered for all records belonging to the given target-type. If the target parameter is PEN, the value may be followed by a parenthetical expression indicating the weapon types effected by this penetration probability. As an example, if the user wants to change the fraction of value at the first time component for all targets to 1 and the penetration probability to target type PAR for BEARS and BIWON to .1 the input is:

```
TGTMOD ALLTGT/FVALT1, 1.   PAR/PEN, .1 (PEAR,BISON)
```

4.2.6 The WPNMOD Adverb. This optional clause is used to modify weapon attributes used in the evaluation. Four attributes may be modified: REL, CEP, DBL and YIELD. The attributes may be modified for all weapon types (ALLWP), all bomber types (BOMBER), all missile types (MISSILE), a particular type or all the weapons in a given weapon group. The form of the clause is a series of phrases, each begun by the name of the type, group (a group is indicated by the mnemonic 'GROUP' followed by a hyphen then the group number), etc. The type indicator is followed by up to four items: a slash, then a legal attribute (REL, CEP, DBL, YIELD), then a comma, followed by the attribute value. For example, if the user wants to set CEP for all bombers to .1 and the YIELD of 144 to 2; a command is:

```
WPNMOD BOMBER/CEP,.1 GROUP-144/YIELD,2
```

4.2.7 The COUNTRIES Adverb. For certain evaluations, it is desired that calculations be performed on a subset of the target list according to input values for countries. This optional clause permits the user to specify which countries (and, hence, individual target records) are to be used in the evaluation. If the special word SELECT is included all countries that follow will be evaluated. If DELETE is used, all countries in the data base will be evaluated minus those countries following the word DELETE.

4.3 Output

4.3.1 Standard Output. The initial prints reflect the parameters as read in from the SETTING adverb and are printed as follows:

```
DAMAGE LAW OPTION IS THE SQUAREROOT LAW
THE TERMINAL MISSILE INTERCEPTORS HAVE PK=0.950000
```

Following evaluation of all target assignments a print is generated which indicates how many targets are involved in the evaluation being performed by EVALALOC. An exerpt of this print is as follows:

THERE ARE 1297 TARGETS OF WHICH 1272 ARE ASSIGNED WEAPONS AND 25 ARE LEFT ALONE

The number of targets is the number of simple, complex and elements of multiple targets.

Summaries as outlined in the following subsection are printed. (Only one of these summaries, the Target Destruction Summary, is provided when the plan is reevaluated using modified parameters.)

4.3.1.1 Target Destruction Summary. This table summarizes the expected target value destroyed as a result of the planned attack (Allocation). The summary, figure 46, shows "real estate" and "QUICK value" destroyed. The former term used to identify the expected target value which would be destroyed assuming target value is not time dependent; i.e., does not degrade over time. "QUICK value" destruction data reflects the time-sensitivity of target value as defined in the data base. The summary shows the total expected target value destroyed and the value destroyed for each target type (attribute TYPE) within each target class (attribute CLASS). In addition, the table provides data on the weapon megatonnage (scheduled and expected to be delivered) which produced the reported target destruction. The Target Destruction Summary is provided for the initial evaluation and for each reevaluation of the plan.

4.3.1.2 Schedule of Weapons Allocated. This summary (figure 47) depicts the number of weapons of each type allocated against each target type. The first five columns contain target information and the remaining contain weapon information. The weapon categories in the summary headings are: (1) ALERT LRA - alert long range aircraft, (2) NONALERT LRA - nonalert long range aircraft, (3) SLBM - submarine-launced ballistic missiles, (4) ICBM - intercontinental ballistic missiles, (5) TACTICAL BOMBERS, (6) MRBM - medium range ballistic missiles, and (7) IRBM - intermediate range ballistic missiles. This summary and the remaining summaries described below are printed only after the first pass through EVALALOC print. Any weapon category not listed here will be included under category ICBM.

Some entries in this schedule show allocation of fractional weapons (see figure 47). This circumstance arises when weapons are allocated to complex targets which include target components of more than one type. For each weapon allocated to a complex target, the amount printed in this summary print reflects the fraction of the weapon allocated to each type as if the weapon were divided proportional to the value of the target components. For example, assume a complex target

TARGET CLASS ①	TARGET TYPE ②	REAL ESTATE (NTS)* NO. OF TARGETS ③	TOTAL ORIGNL VLUE ④	VALUE DSTAYED ⑤	PERCENT DSTAYED ⑥	PERCENT SURVYNG ⑦	QUICK VALUE (TS)* PERCENT DSTAYED ⑧	ESCAPED ⑨	REMNING ⑩	MEGATONS SCHDULED ⑪	MEGATONS DELIVERD ⑫
R/U/I	ALL	122	213.17	121,39	56,94	43.06	56,94	0.00	43.06	386,75	91.42
	RCITY	96	184.84	46,49	44,68	55.48	44,68	0.00	55.48	189.58	46,39
	RCITY-B	26	189.13	74,99	68,72	31.28	68,72	0.00	31.28	117.25	45,83
R/COMMUN	ALL	6	14.64	10,32	70,51	29.49	70,51	-0.00	29.49	10.75	7.64
	RADIO	6	14.64	10,32	70,51	29.49	70,51	-0.00	29.49	10.75	7.64
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	BADGUYS	6	29.28	25,39	86,71	13.29	86,71	-0.00	13.29	28.25	13.28
TOTALS		216	855.66	682,16	79,78	28.22	68,49	12,22	19.33	638.54	264.18

*NTS means "Not Time Sensitive;" TS means "Time Sensitive."

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Figure 46. Target Destruction Summary
(Part 1 of 2)

MEANING	LABEL	DESCRIPTION
(1)	TARGET CLASS	Target class
(2)	TARGET TYPE	Target type
(3)	NO. OF TARGETS	Number of targets
(4)	TOTAL ORIGNL VLUE	Total original value of the targets summed by class and type
(5)	VALUE DSTRYED	Target value destroyed (assuming that the target value is not time dependent)
(6)	PERCENT DSTRYED	Percentage of original target value destroyed (assuming that the target value is not time dependent)
(7)	PERCENT SURVVNG	Percentage of original value that still remains (assuming that the target value is not time dependent)
(8)	DSTRYED	Percentage of original target value destroyed (assuming that the target value is time dependent)
(9)	ESCAPED	Percentage of original target value that has escaped before weapons are delivered (assuming that the target is time dependent)
(10)	REMAINING	Percentage of original target value that still remains after weapons are delivered (assuming that the target value is time dependent)
(11)	MEGATONS SCHDULED	Number of megatons scheduled
(12)	MEGATONS DELIVERD	Number of megatons delivered

Figure 46. (Part 2 of 2)

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SCHEDULE OF WEAPONS ALLOCATED

① TARGET CLASS	② TARGET TYPE	③ TOTAL NUMBER	④ NUMBER ATTACKED ALONE	⑤ NUMBER ATTACKED COMPLEX	⑥ ALERT LRA	⑥ NONALERT LRA	⑥ SLBM	⑥ ICBM	⑥ TACTICAL BOMBERS	⑥ MRBM	⑥ IRBM	⑦ WEAPON TOTALS
INICPTOR	ALL	44	28	36	4.62	34.99	137.87	1.57	0.00	0.00	0.00	179.05
	SPARTAN	12	3	9	0.00	3.83	22.83	0.56	0.00	0.00	0.00	27.17
	F-105	46	24	22	4.62	28.44	105.37	1.01	0.00	0.00	0.00	139.49
	BOMARC	6	1	5	0.00	2.72	9.67	0.00	0.00	0.00	0.00	12.39
	.	.	.	.	.	.	.	.	.	.	.	.
	.	.	.	.	.	.	.	.	.	.	.	.
	.	.	.	.	.	.	.	.	.	.	.	.
	.	.	.	.	.	.	.	.	.	.	.	.
NAVAL	ALL	18	0	7	12.80	21.66	12.81	1.98	0.00	0.00	0.00	49.25
	BNAVAL	18	0	7	12.80	21.66	12.81	1.98	0.00	0.00	0.00	49.25
	TOTALS		948	111	662.00	741.00	1128.00	48.00	0.00	0.00	0.00	2579.00

HEADING	LABEL	DESCRIPTION
①	TARGET CLASS	Name of target class
②	TARGET TYPE	Name of target type
③	TOTAL NUMBER	Total number of targets by type
④	NUMBER ATTACKED ALONE	Number of targets directly attacked
⑤	NUMBER ATTACKED COMPLEX	Number of targets located within a complex which is attacked
⑥	ALERT LRA,...	Number of weapons in each category allocated to various target classes and types *
⑦	WEAPON TOTALS	Total number of weapons allocated by target class and type

Figure 47. Schedule of Weapons Allocated

* See the text section, Schedule of Weapons Allocated, for a discussion of the meaning of fractional entries.

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of value 10.0 composed of two components. One component has value 3.0 and is TYPE BISON. The other component has value 7.0 and is TYPE RCITY. Assume further that one weapon of TYPE B-52 is allocated against that target. This weapon is considered, for purposes of this summary print, to be allocated 0.3 to TYPE BISON and 0.7 to TYPE RCITY. In general, if the component value is VALCM and the total complex value is VALCX, the fractional allocation of each weapon allocated to the type of the component is VALCM/VALCX. Note that the totals line of the summary print shows that an integer number of weapons is allocated for the entire plan.

4.3.1.3 Schedule of Weapons Delivered. This table is a summary by weapon category and target type of the expected number of weapons actually delivered to targets (see figure 48). The entries in this summary are similar to those printed in the preceding summary. The number of weapons delivered is computed as the number of weapons allocated (as displayed in the schedule of weapons allocated) times the average delivery probability for each weapon function/target type combination. Thus, fractional weapon entries in the schedule of weapons delivered arise from two sources. First, the allocated weapons are divided among target types within complexes according to the proportional scheme described in the preceding section, Schedule of Weapons Allocated. Second, the average delivery probability may produce a number of weapons "delivered" that is not an integer. The number printed in this print is the expected number delivered. For example, if 3.0 weapons were allocated to a target type and the average delivery probability is 0.8, then the expected number of weapons delivered is 3.0 x 0.8 = 2.4.

4.3.1.4 Scheduled Megatonnage. This summary depicts the scheduled megatonnage for each target class and type of weapon category. It is illustrated and described by figure 49. Fractional entries in this summary arise from the same source as that described in Schedule of Weapons Allocated.

4.3.1.5 Delivered Megatonnage. This summary is identical in format to the previous one, except that it depicts expected actual delivered megatonnate (see figure 50). Fractional entries in this summary arise from the same sources as those described in Schedule of Weapons Delivered.

4.3.1.6 Allowable Weapon Type Names for WPNMODIF. Normally, the first time EVALALOC is run for a given weapon allocation, the user does not alter weapon or target parameters. To help the user in subsequent runs, the following print of allowable weapon type names (i.e., the type names processed during this evaluation) is provided. This message is printed immediately after the Schedule of Weapons Delivered summary, as shown below:

ALLOWABLE WEAPON TYPE NAMES FOR WPNMODIF

SS-6 SS-7 SS-8 SS-9 N-3 N-5 BADGER BISON BEAR

SCHEDULE OF WEAPONS DELIVERED

① TARGET CLASS	② TARGET TYPE	③ NUMBER	④ ALERT LRA	④ NON-ALERT LRA	④ SLBM	④ ICBM	④ TAC BOMBERS	④ MRBM	④ IRBM	⑤ WEAPON TOTALS
INTCPTOR	ALL	64	0.50	0.63	90.00	0.10	0.00	0.00	0.00	91.23
	SPARTAN	12	0.00	0.09	14.71	0.03	0.00	0.00	0.00	14.83
	F-1C5	46	0.50	0.33	68.99	0.07	0.00	0.00	0.00	70.68
	ADVARC	6	0.00	0.01	6.31	0.00	0.00	0.00	0.00	6.32
	.	.	.	.	.	.	.	.	.	.
	.	.	.	.	.	.	.	.	.	.
	.	.	.	.	.	.	.	.	.	.
	.	.	.	.	.	.	.	.	.	.
NAVAL	ALL	18	7.10	1.72	8.39	0.14	0.00	0.00	0.00	17.34
	SNAVAL	18	7.10	1.72	8.39	0.14	0.00	0.00	0.00	17.34
⑤ WEAPON TYPE TOTALS			370.58	63.11	754.95	3.02	0.00	0.00	0.00	1191.67

HEADING	LABEL	DESCRIPTION
①	TARGET CLASS	Name of target class
②	TARGET TYPE	Name of target type
③	NUMBER	Total number of targets by class and type
④	ALERT LRA, . . .	Expected number of weapons in each category delivered to each target class and target type*
⑤	WEAPON TOTALS	Total number of weapons delivered to each target class and type

Figure 48. Schedule of Weapons Delivered

* See the text section, Schedule of Weapons Delivered, for a discussion of the meaning of fractional entries.

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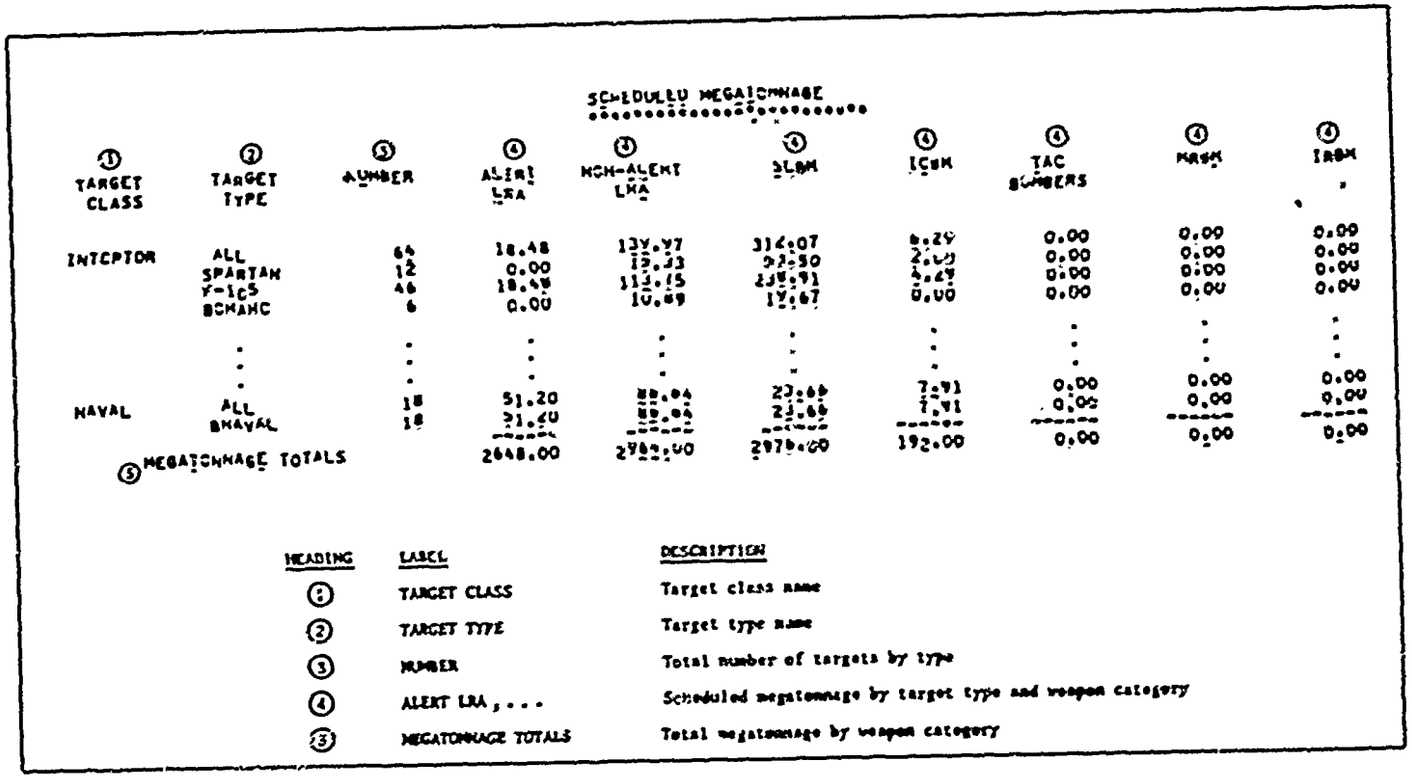

SCHEDULED MEGATONNAGE

① TARGET CLASS	② TARGET TYPE	③ NUMBER	④ ALERT LRA	④ NON-ALERT LRA	④ SLBM	④ ICBM	④ TAC BOMBERS	④ MRBM	④ IRBM
INTCPTOR	ALL	64	18.48	137.97	314.07	6.29	0.00	0.00	0.00
	SPARTAN	12	0.00	12.33	23.50	2.00	0.00	0.00	0.00
	F-15S	46	18.48	113.15	288.91	4.29	0.00	0.00	0.00
	BOMARC	6	0.00	10.89	17.67	0.00	0.00	0.00	0.00
	.	.	.	.	.	.	.	.	.
	.	.	.	.	.	.	.	.	.
	.	.	.	.	.	.	.	.	.
NAVAL	ALL	18	51.20	88.04	23.66	7.91	0.00	0.00	0.00
	BNAVAL	18	51.20	88.04	23.66	7.91	0.00	0.00	0.00
⑤ MEGATONNAGE TOTALS			2648.00	2982.40	2979.00	192.00	0.00	0.00	0.00

HEADING	LABEL	DESCRIPTION
①	TARGET CLASS	Target class name
②	TARGET TYPE	Target type name
③	NUMBER	Total number of targets by type
④	ALERT LRA, . . .	Scheduled megatonnage by target type and weapon category
⑤	MEGATONNAGE TOTALS	Total megatonnage by weapon category

Figure 49. Scheduled Megatonnage

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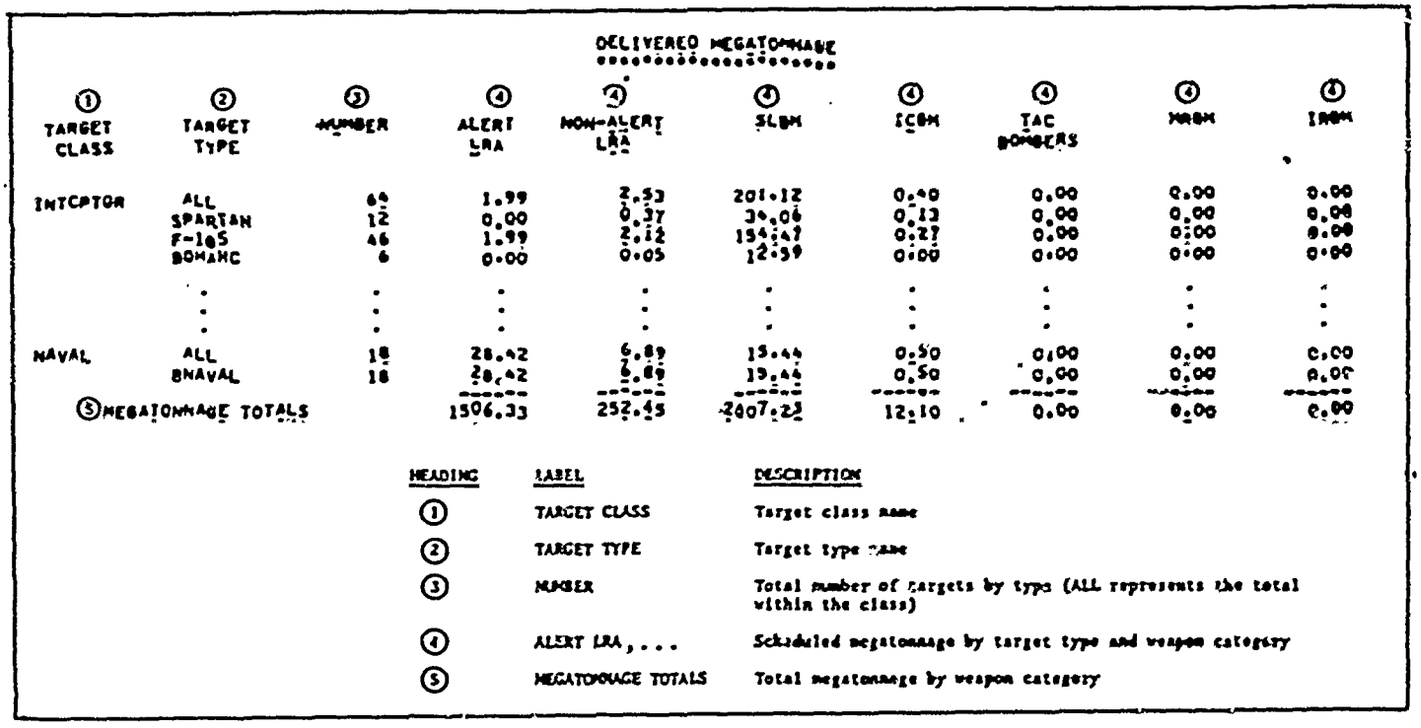

DELIVERED MEGATONNAGE

① TARGET CLASS	② TARGET TYPE	③ NUMBER	④ ALERT LRA	④ NON-ALERT LRA	④ SLBM	④ ICBM	④ TAC BOMBERS	④ MRBM	④ IRBM
INTCPTOR	ALL	64	1.99	2.53	201.12	0.40	0.00	0.00	0.00
	SPARTAN	12	0.00	0.37	34.06	0.13	0.00	0.00	0.00
	F-105	46	1.99	2.12	154.47	0.27	0.00	0.00	0.00
	BOMAHC	6	0.00	0.05	12.59	0.00	0.00	0.00	0.00
	.	.	.	.	.	.	.	.	.
	.	.	.	.	.	.	.	.	.
	.	.	.	.	.	.	.	.	.
NAVAL	ALL	18	28.42	6.89	15.44	0.50	0.00	0.00	0.00
	BNAVAL	18	28.42	6.89	15.44	0.50	0.00	0.00	0.00
⑤ MEGATONNAGE TOTALS			1506.33	252.45	2007.23	12.10	0.00	0.00	0.00

HEADING	LABEL	DESCRIPTION
①	TARGET CLASS	Target class name
②	TARGET TYPE	Target type name
③	NUMBER	Total number of targets by type (ALL represents the total within the class)
④	ALERT LRA, . . .	Scheduled megatonnage by target type and weapon category
⑤	MEGATONNAGE TOTALS	Total megatonnage by weapon category

Figure 50. Delivered Megatonnage

4.3.1.7 Revised Weapon-Target Parameter for Plan Reevaluation. If the plan is to be evaluated using modified weapon or target parameters, the data contained on the WPNMODIF, Target selection on country code, and TGTMODIF parameter cards appears as an initial print in the EVALALOC output which summarizes the reevaluation (the TARGET DESTRUCTION SUMMARY is provided for each plan evaluation performed during the run, whereas the other summaries are produced only once each run). A sample of the output message reflecting these data is shown in figure 51.

4.3.2 Nonstandard Output. There is only one non-standard report generated. This report (figure 52) is produced for the number of targets indicated within the ONPRINTS clause. If the SORT adverb is absent; the report produces results in target number order. Otherwise the list is sorted by the targets' region, country code and designator. A header identifying the region and country of each target is supplied only when SORT is included in the command.

4.3.3 Error Messages. The error messages generated by module EVALALOC are shown in figure 53.

```
                              WEAPON TYPES AND ATTRIBUTES MODIFIED ON THIS PASS

 WPNTYPE   ATTRIBUTE   ATTRB CHANGED
MODIFIED   MODIFIED    BY FACTOR OF
    ALLWPN  0      YIELD        10.0000
    ALLWPN  3      DBL           1.0000


 ALL MODIFICATIONS MADE. IF THE ABOVE TABLE IS EMPTY ,NO WEAPON CHANGES WERE MADE ON THIS PASS


SELECT TARGETS WITH THESE COUNTRY CODES
HG AL
    NPASS              2

                                                TARGET MODIFICATIONS ON THIS  PASS/
 TGTTYPE ATTRIBUTE  CHNGED BY  WEAPON TYPES FOR WHICH PENETRATION
 CHANGED  CHANGED   FACTOR OF  PROBABILITY HAS CHANGED BY FACTOR
   ALLTGT     PEN       0.5000    ALLWPN
   ALLTGT     TAU(1)    000000
```

Figure 51. Weapon and Target Modification Print

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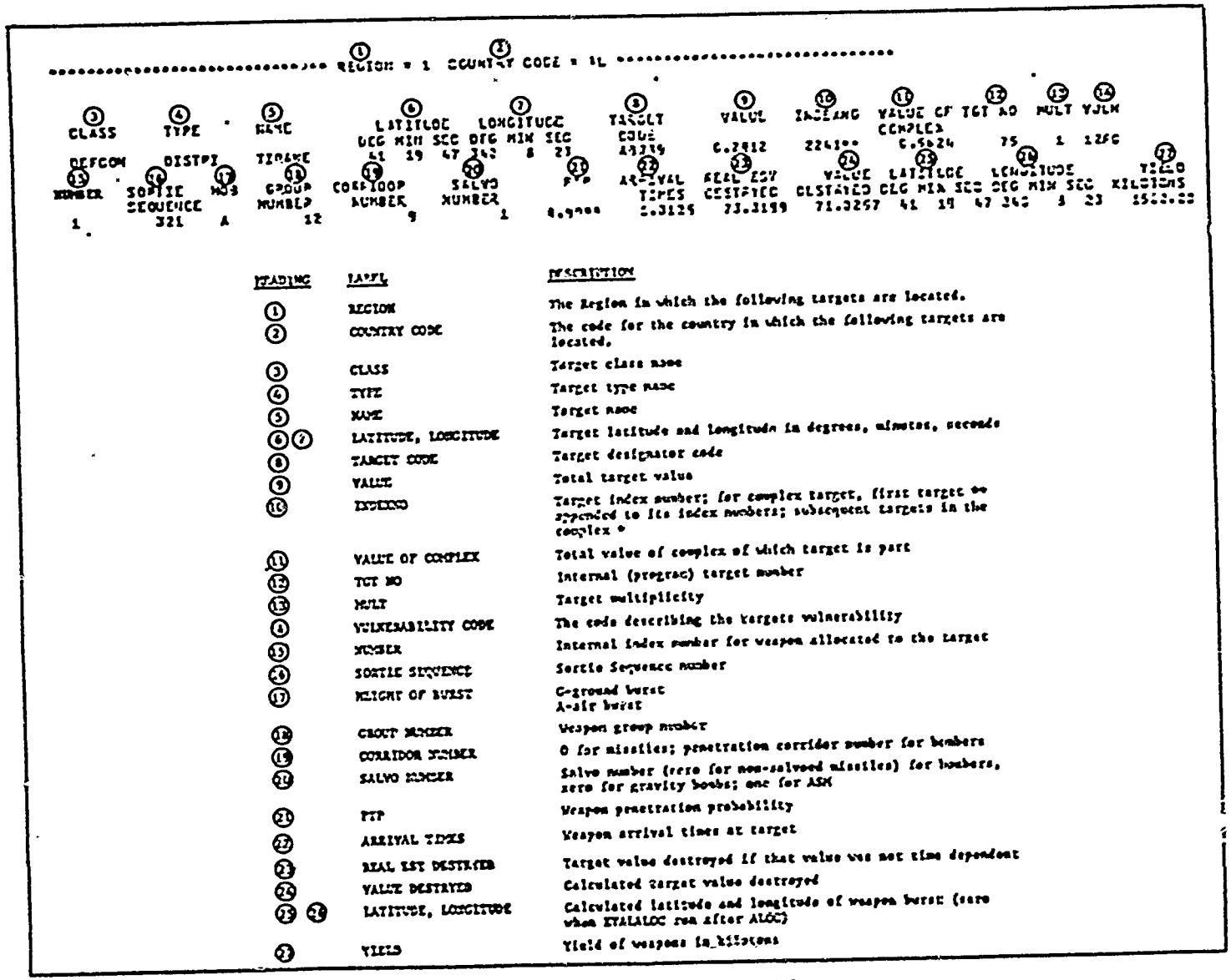

HEADING	LABEL	DESCRIPTION
1	REGION	The Region in which the following targets are located.
2	COUNTRY CODE	The code for the country in which the following targets are located.
3	CLASS	Target class name
4	TYPE	Target type name
5	NAME	Target name
6 7	LATITUDE, LONGITUDE	Target latitude and longitude in degrees, minutes, seconds
8	TARGET CODE	Target designator code
9	VALUE	Total target value
10	INDEXNO	Target index number; for complex target, first target so appended to its index numbers; subsequent targets in the complex *
11	VALUE OF COMPLEX	Total value of complex of which target is part
12	TGT NO	Internal (prograc) target number
13	MULT	Target multiplicity
14	VULNERABILITY CODE	The code describing the targets vulnerability
15	NUMBER	Internal index number for weapon allocated to the target
16	SORTIE SEQUENCE	Sortie Sequence number
17	HEIGHT OF BURST	G-ground burst A-air burst
18	GROUP NUMBER	Weapon group number
19	CORRIDOR NUMBER	0 for missiles; penetration corridor number for bombers
20	SALVO NUMBER	Salvo number (zero for non-salvoed missiles) for bombers, zero for gravity bombs; one for ASM
21	PTP	Weapon penetration probability
22	ARRIVAL TIMES	Weapon arrival times at target
23	REAL EST DESTRCD	Target value destroyed if that value was not time dependent
24	VALUE DESTROYED	Calculated target value destroyed
25 26	LATITUDE, LONGITUDE	Calculated latitude and longitude of weapon burst (zero when ESTALOC run after ALOC)
27	YIELD	Yield of weapons in kilotons

Figure 52. Sample Target List

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1	(I3) IS AN ILLEGAL ADVERB NUMBER FOR EVALUATE -- IT WAS THE (I3)(A2) ADVERB The indicated adverb is not legal.
2	(I5) IS NOT THE VERB FOR EVALUATE -- CHECK COP Module EVALALOC executed with the incorrect verb.
3	UNEXPECTED FUNCTION CODE OF (A6) FOR (A6) FUNCTION ASSUMED TO BE (A6) An unknown function code was encountered. Check data base entries.
4	ONPRINTS NOT FOLLOWED BY A NUMBER -- NO SAMPLE TARGETS WILL BE PRINTED The print adverb does not specify how many targets are to be printed.
5	SETTING CLAUSE CONTAINS A NON-ATTRIBUTE (I5) (8013) Check spelling in SETTING clause.
6	ATTRIBUTE NOT BEING SET TO A CONSTANT The SETTING clause is restricted to setting the value of an attribute to a specific value.
7	END OF PHRASE BUT CANNOT FIND MARKER OR CONNECTOR Check text English syntax.
8	COUNTRIES NOT FOLLOWED BY INCLUDE EXCLUDE (012) (I5) ASSUMING INCLUDE Check for spelling of include/exclude.
9	COUNTRY CODE NOT FOLLOWED BY COMMA OR END OF CLAUSE ((2013) (I5)) Country codes must be separated by a comma. Check for a country code which is a COP special word or null.
10	TARGET TYPE NOT FOUND IN TGTMODIF Check target type spelling in TGTMODIF clause.

Figure 53. EVALALOC Error Messages (Part 1 of 3)

11	ALPHABETIC COUNTRY CODE NOT FOUND ((2013) @ (I5))
	See if a country code in the list is a special word or a null.
12	SLASH MISSING AFTER TYPE IN TGTMODIF
	Check syntax in TGTMODIF clause.
13	NON-NUMERIC ATTRIBUTE TO BE MODIFIED
	Only numeric attributes can be modified.
14	COMMA DOES NOT FOLLOW ATTRIBUTE
	Check for extra spaces in TGTMOD or WPNMOD clauses.
15	MODIFIER IS NOT NUMERIC
	Attribute can only be modified by a numeric factor.
16	LOST AFTER MODIFIER
	Operator probably missing in modification clauses.
17	WEAPON TYPE NOT ALPHABETIC
	Weapon in TGTMOD clause probably has a blank or an operator and is not enclosed in quotes.
18	WEAPON NOT FOLLOWED BY) OR ,
	All weapon types must be separated by commas. Check for a type name with an operator, that is not enclosed in quotes.
19	NO GROUP HEADER FOR SIDE
	Major data base error. Side specified does not have a group header.
20	NO TARGET LIST
	The data base has not been PREPARE'd yet.
21	ATTRIBUTE NUMBER (I4) IS NOT GROUP -- CHANGE IGNORED
	Check group spelling inputs.

Figure 53. (Part 2 of 3)

22	'GROUP' NOT FOLLOWED BY DASH -- LOOKING FOR NUMBER 'GROUP' and the group number should be separated by a dash. Make certain WPNMOD is correct.
23	LOST LOOKING FOR TYPE INDICATOR ((2013) @ (I5)) Check WPNMOD clause for split alphanumerics or stray operators.
24	'WEAPON' NOT FOLLOWED BY DASH -- LOOKING FOR TYPE 'WEAPON' and the weapon type should be separated by a dash. Make certain the WPNMOD clause does not have errors.
25	'WEAPON' NOT FOLLOWED BY A NAME Weapon modification is requested but the type is not specified. Look for extraneous blanks or operators.
26	MODIFICATION INDICATOR NOT FOLLOWED BY A / Check for weapon type with a dash, which is not enclosed in quotes.
27	ATTRIBUTE TO B MODIFIED ((I3) 0 IS NOT CEP, REL YIELD @ (I5) Check spelling of text English inputs.
28	ATTRIBUTE NOT FOLLOWED BY COMMA -- ASSUMED MISSING A comma should operate the attribute and its modification factor. Check the clause for any other errors.
29	WEAPON MODIFICATION IS NON-NUMERIC -- IGNORED Weapon attributes can only be modified by a constant.

Figure 53. (Part 3 of 3)

SECTION 5. MODULE ALOCOUT

5.1 General Purpose

Module ALOCOUT selects optimal aim point offsets for weapons allocated to complex targets and reorders the weapon group assignment chains for use within the Sortie Generation subsystems. For missile groups, the sort in according to salvo number and within salvo, according to attribute RVAL. For bomber groups the new order is a collection of strikes belonging to the penetration corridor that has the largest number of assignments followed by strikes of the penetration corridor that has the next largest number of assignments and so on. Within each collection of strikes belonging to the same penetration corridor, the assignments are further sorted based on attribute RVAL.

5.2 Input

The only options available to the user in module ALOCOUT are to specify the type and frequency of the various prints and/or to specify the maximum number of iterations to be executed by the generalized function minimizes which is used to select the aim point offsets for those weapons assigned to complex targets. The general command is:

DGZSELECT [ONPRINTS option option . . .]
[FINDMIN imax]

5.2.1 The ONPRINTS Adverb. This adverb selects various print or calculation options. It recognizes any series of numbers (each number separated by at least one blank) with values varying from one to nine. The presence of any of the numbers within the clause selects the corresponding option which are:

- 1 -- Selects the detailed target print. For this option only a print frequency may be selected. This is entered by placing a slash (/) after the number one followed by the numeric value of the desired print frequency. An entry of 1/10 will print every ten targets. The default entry (1 by itself) prints all targets
- 2 -- Selects the bomber weapon group summary print
- 3 -- Selects the missile weapon group summary print
- 4 -- If entered offsets are not calculated
- 5 -- Selects the target data input to subroutine DGZSEL print
- 6 -- Selects the DGZSEL computational value print

- o 7 -- Selects the DGZSEL improvement print
- o 8 -- Selects maintenance prints
- o 9 -- Selects timing information print

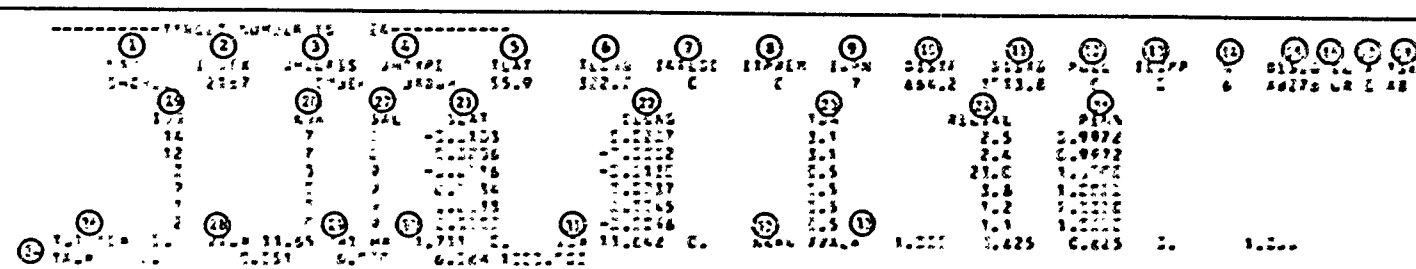
5.2.2 The FINDMIN Adverb. If absence the FINDMIN subroutine is not used. If present the FINDMIN subroutine is used and parameter 'imax' is set to the maximum number of iterations.

5.3 Output

5.3.1 Standard Output. All output is optional and must be selected by the user.

5.3.2 Nonstandard Output. Figures 57 to 60 presents the output for print options available to the user within the ONPRINTS clause.

5.3.3 ALOCOUT Error Messages. The error messages for ALOCOUT are shown in figure 61.



HEADING	LABEL	DESCRIPTION
(1)	NAME	Target name for first target component)
(2)	INDEX	Index number (for first target component)
(3)	JHCLASS	Target class name
(4)	JHTYPE	Target type name (except for complex targets where it is the number of elements in the complex)
(5)	TLAT	Target latitude
(6)	TLONG	Target longitude
(7)	IATLOC	State of local bomber defense
(8)	ITPREM	Complex target indicator (=1 if complex target; =0 otherwise)
(9)	IDPN	Depenetration corridor index for target
(10)	DISTF	Distance from target to point of depenetration
(11)	DISTG	Distance from target to recovery base

Figure 54. Print Option 1: Detailed Target Print
(Part 1 of 3)

HEADING	LABEL	DESCRIPTION
(12)	MULL	Multiple target indicator (=current target multiplicity if multiple target; =0 otherwise)
(13)	ICOMP	Target type for complex target, and 0 otherwise
(14)	N	Number of weapons allocated to target
(15)	DESIG	Target designator, country location, and flag and task codes respectively
(16)	CL	
(17)	F	
(18)	TSK	
(19)	IGG	Group number of weapon allocated to the target
(20)	KOR	Weapon penetration corridor or, in case weapons are missiles, the number of missiles from the group assigned to the target
(21)	DLAT	Offset latitude and longitude, respectively, for weapon delivery
(22)	DLONG	
(23)	TOA	Time of arrival for weapon delivery
(24)	RELVAL	Relative value of weapon allocation divided by weapon penetration probability
(25)	PENNAD	Weapon penetration probability
(26)	TGTRAD	Target radius

Figure 54. (Part 2 of 3)

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HEADING	LABEL	DESCRIPTION
(27)	SAL	Salvo number (zero for non-salvoed missiles). For bombers, zero for gravity bomb, one for ASM
(28)	VTO	Original target value
(29)	M	Number of hardness components
(30)	H	Lethal radius for both hardness components
(31)	VO	Target value for both hardness components
(32)	NK	Number of time sensitivity points
(33)	FVAL	Fraction of target value at each time point
(34)	TAU	Time sensitivity points

Figure 54. (Part 3 of 3)

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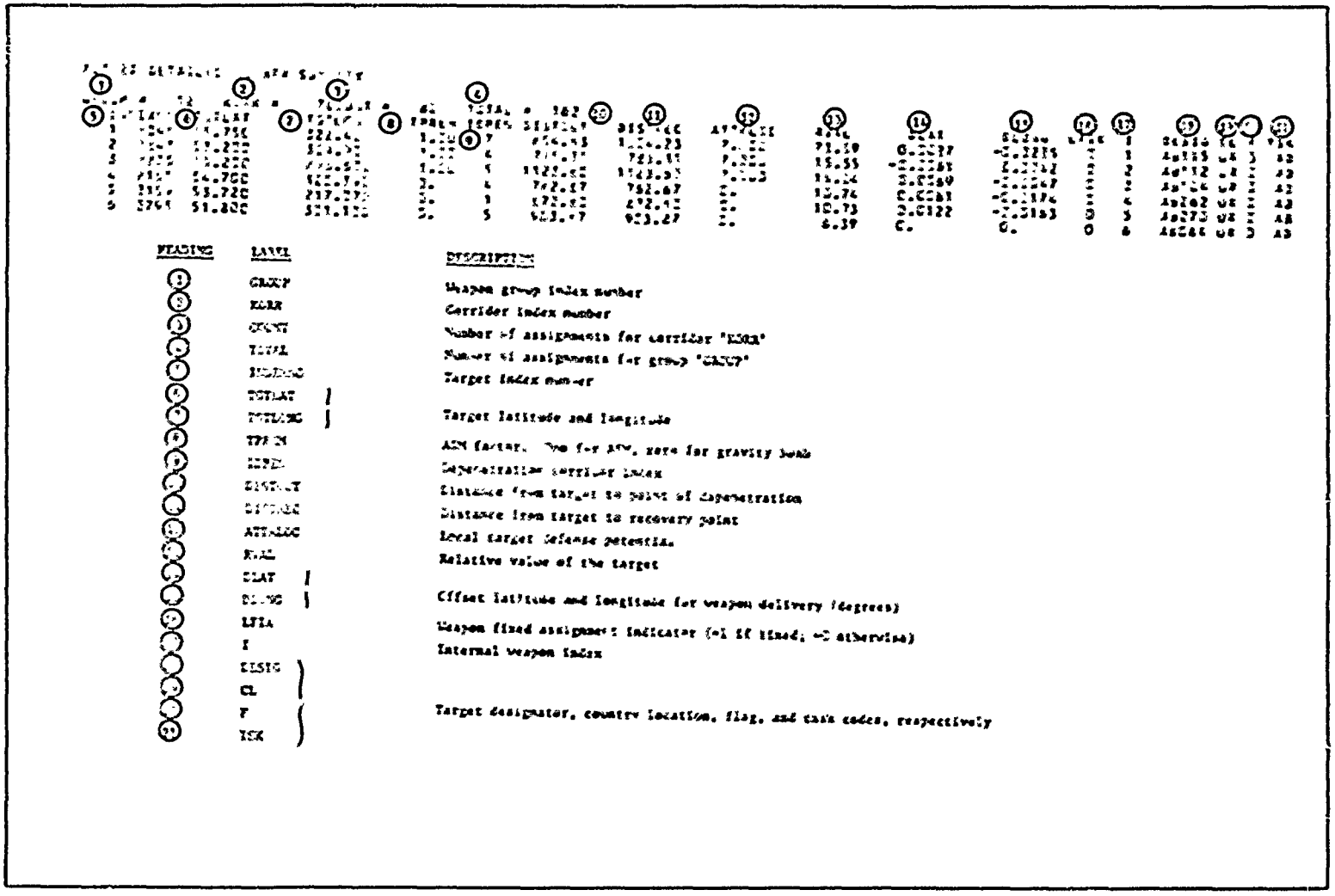

HEADING	LABEL	DESCRIPTION
①	GROUP	Weapon group index number
②	CORR	Corridor index number
③	COUNT	Number of assignments for corridor 'CORR'
④	TOTAL	Number of assignments for group 'GROUP'
⑤	TGTNO	Target index number
⑥	TGTLAT	Target latitude and longitude
	TGTLONG	
⑦	TYPEN	ASM factor. One for ASM, zero for gravity bomb
⑧	PENET	Penetration corridor index
⑨	DISTPT	Distance from target to point of penetration
⑩	DISTREC	Distance from target to recovery point
⑪	ATTADC	Local target defense potential
⑫	VALUE	Relative value of the target
⑬	OLAT	Offset latitude and longitude for weapon delivery (degrees)
	OLONG	
⑭	LFIX	Weapon fixed assignment indicator (=1 if fixed, =0 otherwise)
⑮	I	Internal weapon index
⑯	DESIG	Target designator, country location, flag, and task codes, respectively
	CL	
	F	
	TSK	

Figure 55. Print Option 2: Detailed Bomber Summary

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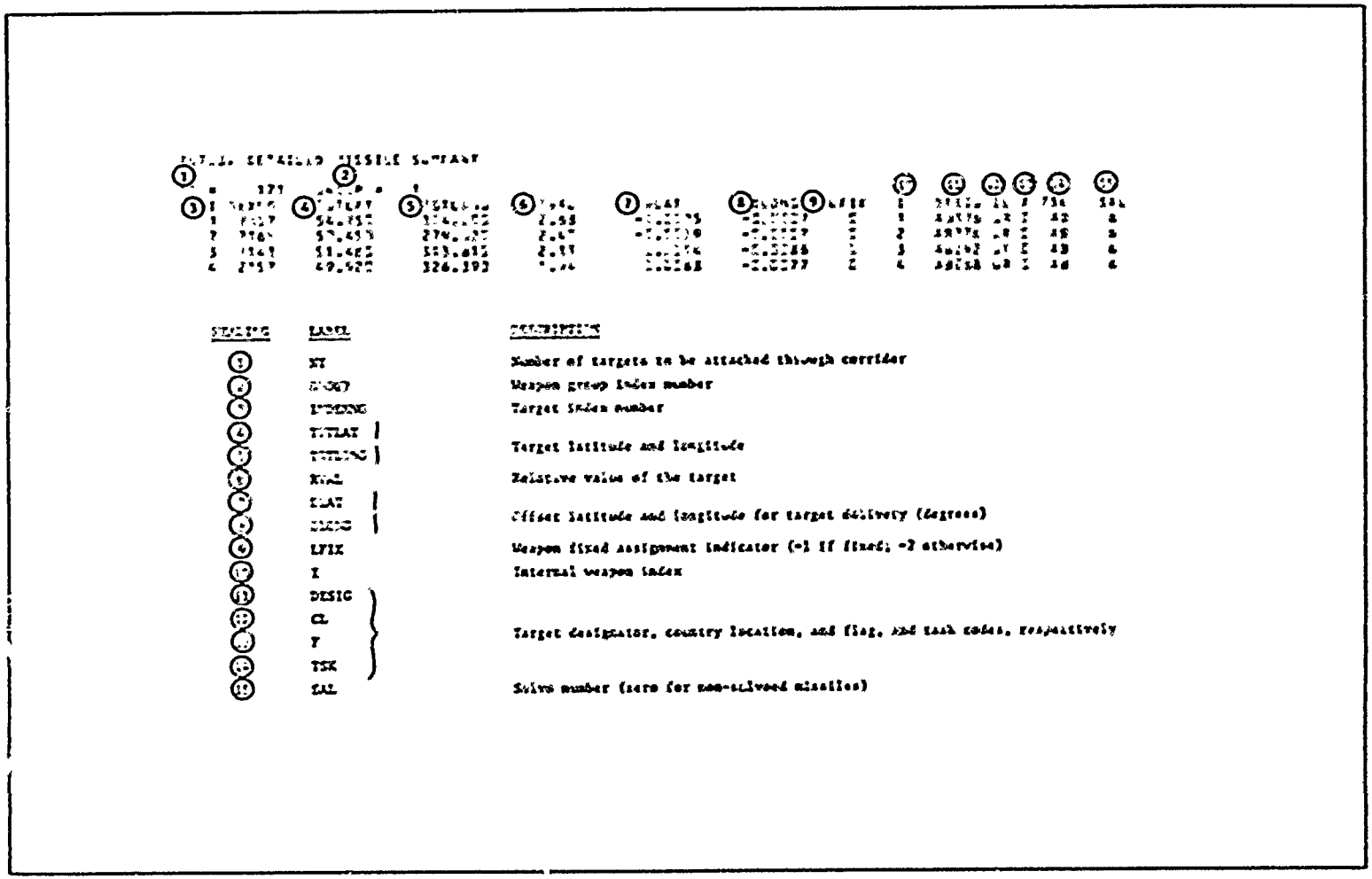

STATUS	LABEL	DESCRIPTION
1	XT	Number of targets to be attacked through corridor
2	[illegible]	Weapon group index number
3	[illegible]	Target index number
4	TGTLAT	Target latitude and longitude
5	[illegible]	
6	[illegible]	Relative value of the target
7	XLAT	Offset latitude and longitude for target delivery (degrees)
8	[illegible]	
9	LFIX	Weapon fixed assignment indicator (=1 if fixed; =2 otherwise)
10	I	Internal weapon index
11	DESIG	Target designator, country location, and flag, and task codes, respectively
12	CL	
13	F	
14	TSK	
15	SAL	Salvo number (zero for non-salvoed missiles)

Figure 56. Print Option 2: Detailed Missile Summary

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TGT DATA INPUT TO DGZSEL

TGTEL ①	1	2	3	4
XO ②	0.745d10	-0.902489	0.110597	1 42
YO ③	-0.861090	-0.123431	0.584948	2.024138
RADL ④	2.829217	2.829217	2.829217	2.829217
VI ⑤	0.137391	0.137391	0.137391	0.137391
VTCA(1) ⑥	0.137391	0.137391	0.137391	0.137391
VTCA(2)	0.137391	0.137391	0.137391	0.137391
VTCA(3)	0.137391	0.137391	0.137391	0.137391
VTCA(4)	0.137391	0.137391	0.137391	0.137391
VTCA(5)	0.137391	0.137391	0.137391	0.137391

⑦ WPN	⑧ PDEL	⑨ ERDFL	⑩ YDSCL
1	0.810000	1.000000	1.012909
2	0.719597	0.500000	233106
3	0.718460	0.500000	1.235592
4	0.139694	0.500000	1.216440
5	0.150915	0.500000	1.228670

HEADING	LABEL	DESCRIPTION
①	TGTEL	Target element number ($J \leq 7$)
②, ③	XO(J), YO(J)	E-W and N-S displacements, respectively, of target element J in nautical miles
④	RADL(J)	One-megaton lethal radius for target element J
⑤	VI(J)	Initial value of target element J
⑥	VTOA(J,I)	Value of target element J immediately after the arrival of weapon I
⑦	WPN	Internal weapon index (I)
⑧	PDEL(I)	Delivery probability for the Ith weapon
⑨	ERDEL(I)	CEP for weapon I
⑩	YDSCL(I)	Scaled weapon yield $= \left[\text{(actual yield)}\right]^{1/3}$

Figure 57. Print Option 5: Target Data Input to DGZSEL Debug Print

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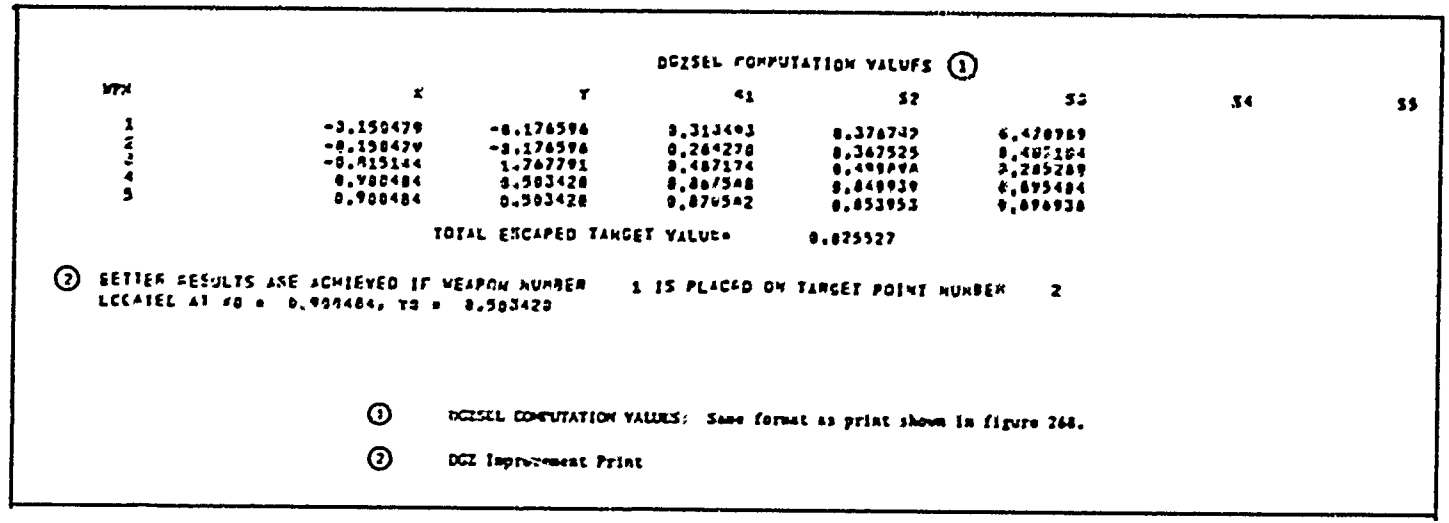
DGZSEL COMPUTATION VALUES

① WPN	② X	③ Y	④ S1	⑤ S2	⑥ S3	⑦ S4	⑧ S5
1	0.118597	0.534948	0.482132	0.436289	0.348630	0.551396	
2	0.118597	0.534948	0.425455	0.384804	0.308793	0.488238	
3	0.118597	0.534948	0.425862	0.385402	0.309781	0.488373	
4	0.118597	0.534948	0.889138	0.881078	0.865964	0.981547	
5	0.118597	0.534948	0.879694	0.871121	0.855881	0.802927	

⑨ TOTAL ESCAPED TARGET VALUES 0.034145

HEADING	LABEL	DESCRIPTION
①	WPN	Internal weapon index
②	X(I)	Offset aim coordinates for weapon (in nautical miles)
③	Y(I)	Offset aim coordinates for weapon (in nautical miles)
④ ↓ ⑧	S1 ↓ S5	Survival probability of target element J relative to weapon I (J = 1,5)
⑨	VESCTOT	Total escaped target value

Figure 58. Print Option 6: DGZSEL Computation Values Debug Print



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DGZSEL COMPUTATION VALUES (1)

WPN	X	Y	S1	S2	S3	S4	S5
1	-0.150479	-0.176596	0.313493	0.376742	0.470969		
2	-0.150479	-0.176596	0.264270	0.367525	0.487104		
3	-0.815144	1.767791	0.487174	0.499898	0.285289		
4	0.900484	0.503428	0.867548	0.849939	0.895484		
5	0.900484	0.503428	0.870542	0.853953	0.896938		

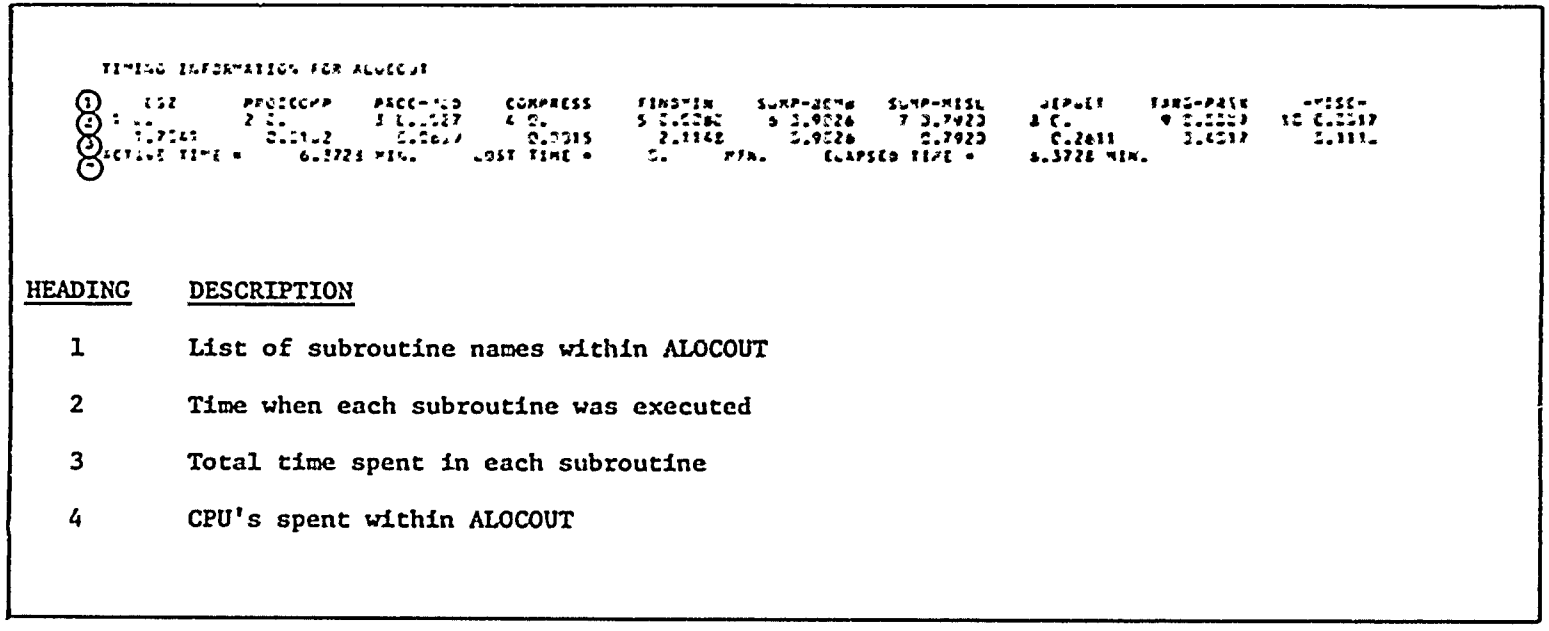
TOTAL ESCAPED TARGET VALUE= 0.025527

(2) BETTER RESULTS ARE ACHIEVED IF WEAPON NUMBER 1 IS PLACED ON TARGET POINT NUMBER 2
LOCATED AT X0 = 0.900484, Y0 = 0.503428

(1) DGZSEL COMPUTATION VALUES: Same format as print shown in figure 268.

(2) DGZ Improvement Print

Figure 59. Print Option 7: DGZ Improvement Print



HEADING	DESCRIPTION
1	List of subroutine names within ALOCOUT
2	Time when each subroutine was executed
3	Total time spent in each subroutine
4	CPU's spent within ALOCOUT

Figure 60. Print Option 9: ALOCOUT Timing Print

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1	MODULE ALOCOUT CANNOT DETERMINE ADVERB (012) Check for correct spelling within the command.
2	ERROR IN ONPRINTS CLAUSE Check for proper syntax within ONPRINTS clause.
3	*** ERROR--NFIX = _ _ _ _ _ _ _ NFIX, the number of weapons allocated through the fixed assignment capability, is negative; the run is aborted.
4	*** _ _ _ _ _ _ _ _ _ _ *** ABANDON DGZSEL ON COMPLEX TARGET NAME INDEX COMPONENT TGTNAME INDEXNO *** _ _ _ _ _ _ _ _ _ _ *** Subroutine COMPRESS has been entered with open tolerances more than 20 times in succession so no further attempt to use DGZSEL is made for this target.
5	*** TOLERANCES DOUBLED N TIMES IN SUBROUTINE COMPRESS TO REDUCE NUMBER OF TARGET POINTS TO 40. TARGET NAME INDEX NUMBER INDEX COMPRESS doubled tolerances N times to reduce number of target elements. NAME is the target name. INDEX is the target index number. This is a message produced by subroutine COMPRESS, but is not an error message.
6	ALOCOUT PROCESSING COMPLETED ON IW WEAPONS IT TARGETS Statement of number of weapons and targets processed by ALOCOUT, where number of targets is the sum of the numbers of simple and complex targets and multiple target elements, which were assigned weapons.
7	BAD CALL ON ERGOT More than 10 serires are being run in parallel; control is returned to the calling subprogram without computing ERGOT1.

Figure 61. ALOCOUT Error Messages

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EXTERNAL	
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Chief of Naval Operations, ATTN: OP-96C4, Room 4A478, Pentagon, Washington, DC 20350	2
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4. TITLE (and Subtitle) THE CCTC QUICK-REACTING GENERAL WAR GAMING SYSTEM (QUICK), Users Manual, Weapon Allocation Subsystem		5. TYPE OF REPORT & PERIOD COVERED
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Dale J. Sanders Paul F. M. Maykrantz Jim M. Herron		8. CONTRACT OR GRANT NUMBER(s) DCA 100-75-C-0019
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)
War Gaming, Resource Allocation.

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)
The computerized Quick-Reacting General War Gaming System (QUICK) will accept input data, automatically generate global strategic nuclear war plans, provide statistical output summaries, and produce input tapes to simulator subsystems external to QUICK.
The Users Manual consists of four volumes which are intended for the user/analyst who is concerned with preparing the data base for a war game, selecting optional features of QUICK, designating control parameters, submitting computer jobs, and analyzing computer output. This volume, Volume III, provides

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detailed instructions for execution of the Weapon Allocation Subsystem and the modules it comprises.
The Users Manual complements the other QUICK Manuals to facilitate application of the war gaming system. These manuals Series 9-77 are published by the Command and Control Technical Center (CCTC), Defense Communications Agency (DCA), The Pentagon, Washington, DC 20301.

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